

Improving Care for Acute and Chronic Problems with Smart Forms and Quality Dashboards

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Harvard Medical School

Division of General Medicine and Primary Care

Brigham and Women's Hospital

Harvard Medical School

Clinical Informatics Research and Development

Partners HealthCare System

Agenda

- Brief Introduction to Partners IS
- Motivation for Smart Forms and Quality Dashboards
 - LMR, Patient Gateway
 - The Signature Initiatives -> High Performance Medicine
 - Partners Advanced Informatics Infrastructure
- SFQD Study Design
 - Preliminary Focus Group and Survey Data
- Architecture and Software Overview
 - Smart Forms
 - Quality Dashboards
- Discussion

Partners HealthCare – NHII *in situ*

- Founded in 1994
 - Brigham and Women's Hospital
 - Massachusetts General Hospital
- Now includes:
 - Community Physician Network
 - 2 Rehab Hospitals
 - 4 Community Hospitals
 - Affiliated cancer hospital – Dana Farber
- Common Clinical IT supported by Partners Information Systems



Overview of Partners IS: Scale of the Integration Effort

- 55,000 devices attached to the Partners network
- 45,000 users accounts
- 110 locations on the network
- 750 servers
- 800 applications
- 540 active projects
- 1,100 employees based in 19 locations



What Are the Signature Initiatives?

The Signature Initiatives are five System-wide projects with one common goal:

To deliver better care to patients.

- **Care that is:**
 - **Safer**
 - **Better coordinated**
 - **More reliable in delivering proven interventions**
- **Systems that support providers in “doing the right thing.”**



What Are the Signature Initiatives?

- Infrastructure**
1. Investing in quality and utilization infrastructure
 - Information systems
 - Other resources
-
- Initiative Focus**
- Quality** ↑
- ↓ **Efficiency**
2. Enhancing patient safety by reducing medication errors system-wide
 3. Enhancing uniform high quality by measuring performance to benchmark for select inpatient and outpatient conditions
 4. Expanding disease management programs by supporting activities for certain patients with chronic illnesses
 5. Improving cost effectiveness through managing utilization trends and analysis of variance





Quite possibly the biggest development in patient care since the telephone.

When Alexander Graham Bell invented the telephone in Boston in 1875, he was able to call his assistant in a nearby room using a wire.

Today your physician can instantly call up your medical history, tests, medications and physicians' notes on a computer screen.

It's called electronic medical record, EMR, and it's part of what we at Partners HealthCare call High Performance Medicine.

We began installing EMR in 2003. Today about 90 percent of our primary care physicians have it at our two academic medical centers, Brigham and Women's Hospital and Massachusetts General Hospital.

Two of our community hospitals, Faulkner Hospital and Newton-Wellesley Hospital are finalizing implementation of EMR now. Our hospitals in North Shore Medical Center expect full implementation by next June. Among our community-based primary care physicians, more than 60 percent are using EMR or are in the course of implementing it.

High Performance Medicine provides our doctors with guidance on the appropriate tests to order. For example, EMR tells them when an x-ray will be just as revealing as an MRI, but at a fraction of the cost.

Physicians can write prescriptions on-line. This allows them to safely

order the right medication, detect any allergies you might have, and know which other medications you are taking, in order to avoid dangerous drug interactions.

Prescribing by computer also displays which generic drugs are effective, which have the lowest co-pay, and which are covered by your insurance.

High Performance Medicine brings technological advances to the doctor's office, the pharmacy, and the neighborhood health center.

We believe EMR will soon be used as effortlessly as the telephone. But with the power to help your doctor diagnose, treat and heal.

For more information, go to www.Partners.org/HPM.

HIGH PERFORMANCE MEDICINE

Better, safer, more cost-effective care.

BRIGHAM AND
WOMEN'S HOSPITAL

 **PARTNERS**
HEALTH CARE

A charitable non-profit organization

MASSACHUSETTS
GENERAL HOSPITAL



No one should have to
decipher your doctor's
handwriting to give you
the right prescription.

When your pharmacist can read clearly what your physician prescribed, that means you're getting the right medication at the right dosage. This happens automatically when your doctor orders prescriptions by computer.

Physicians who prescribe by computers rather than pen and pads get alerts that point out allergies you might have to certain medications. They see all medications prescribed by other doctors in the Partners HealthCare system. This minimizes dangerous drug interactions. (Literally thousands of interactions are possible.)

There's no need to translate your doctor's handwriting. Or rely on your memory. Everything is clearly and securely kept in your doctor's computer.

Your doctor can use a coding system developed by Partners pharmacists that says which generic drugs are safe and effective alternatives to heavily advertised ones. It even tells them which prescriptions are covered by your insurance and have the lowest co-pay.

Medication orders are automated at our founding hospitals, Brigham and Women's and Massachusetts General, as well as at Faulkner Hospital and Newton-Wellesley Hospital. It is the process of being implemented at our hospitals in North Shore Medical Center.

About 60 percent of Partners community-based primary care physicians also can prescribe by computer and that number grows every week.

This upgrading is part of what we call High Performance Medicine. HPM takes advantage of digital technology to make our already outstanding care even better.

But the best reason for prescribing by computer is that it is safer for our patients. And it doesn't take an Egyptologist to understand that's good for all of us.

For more information, go to www.Partners.org/HPM.

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GENERAL HOSPITAL

Business Goals Drive IT Objectives

- Business Goals
 - Enhancing patient safety by reducing medication errors
 - Enhancing uniform high quality by measuring performance
 - Expanding disease management programs
 - Improving cost effectiveness through managing utilization trends
 - Improving patient care access and convenience
- IT Objectives
 - Support key business initiatives through the design and implementation of improved IT infrastructure
 - Bridge system silos to make information available everywhere
 - Achieve enterprise wide interoperability of key data types to support decision support and data aggregation
 - Manage knowledge to achieve uniform best practices
 - Make results visible to drive process improvement



Increasing Enterprise Integration: Progressive Homogeneity via SOA

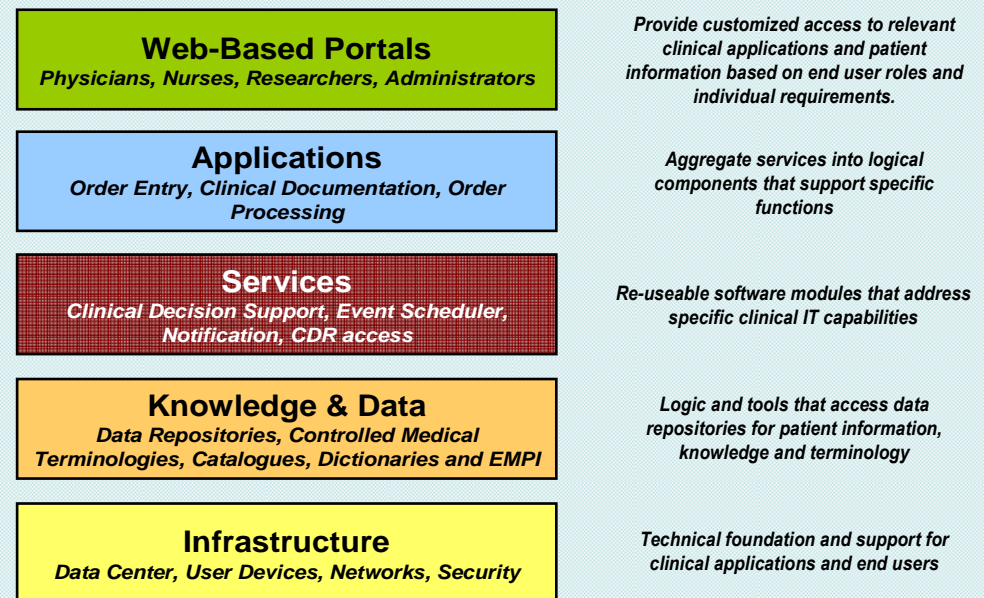
Increasing the level of enterprise integration is supported by core IT services that can be integrated with and/or accessed by site-based applications.

These IT services integrate and communicate with the site-based and enterprise applications via a *service-oriented architecture* made up of layered components.

This approach leverages:

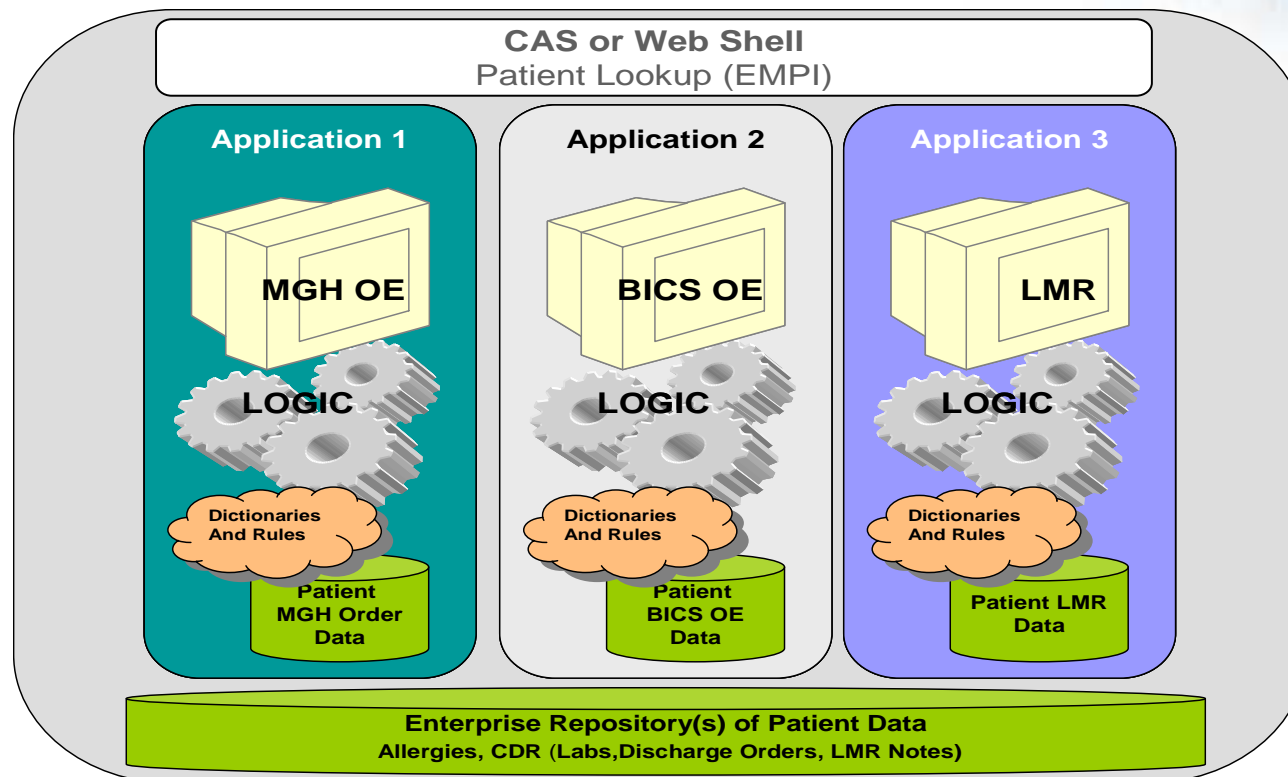
- A common technology infrastructure;
- Common data, terminology and rules (especially those associated with allergies, problems and medications);
- Shared clinical services and applications; and
- Customized views and capabilities for specific user types.

Overview of a Service-Oriented Architecture



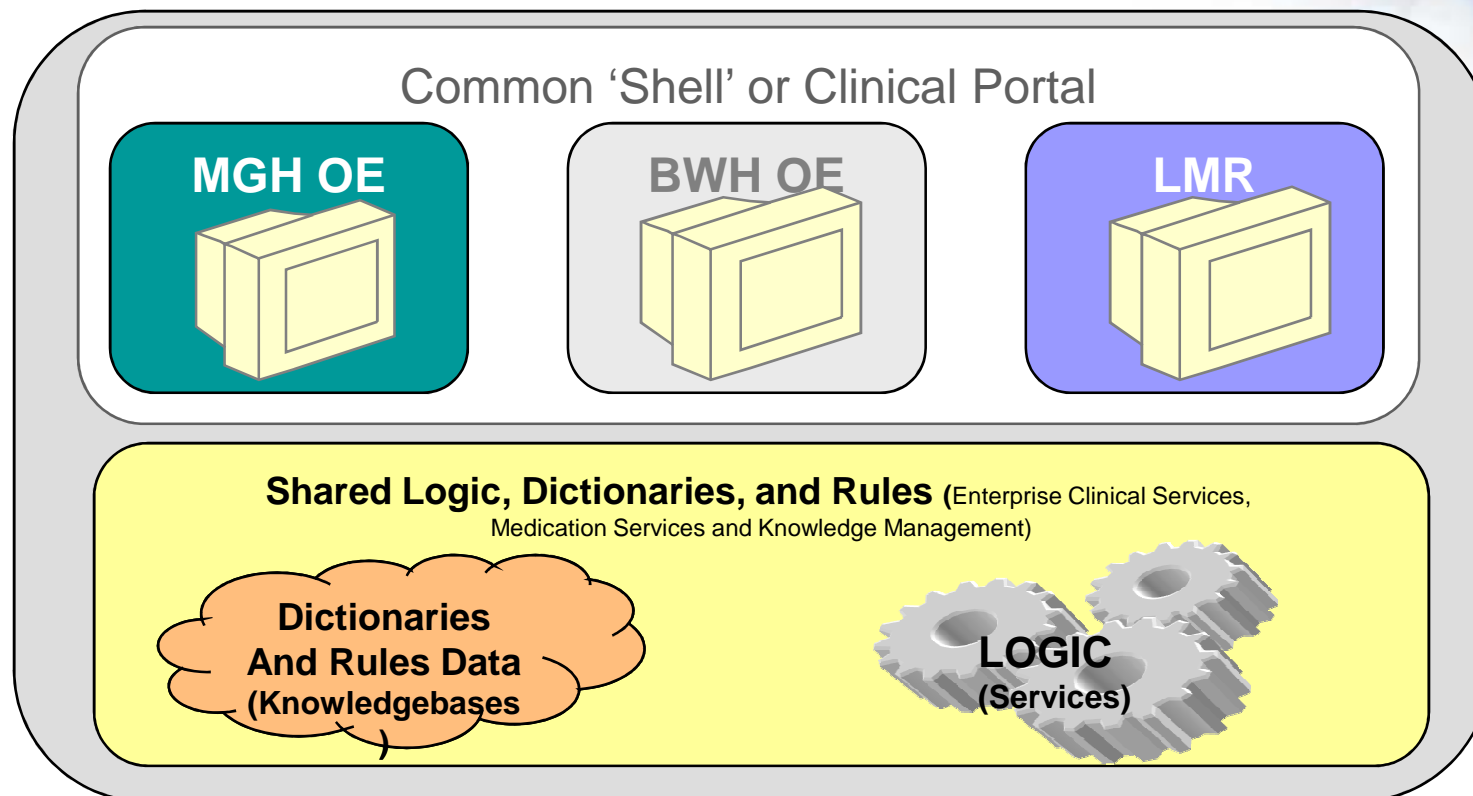
Discrete vs. Shared Data, Knowledge, Logic

Many Partners' applications utilize discrete data, logic and knowledge or rules; most are not integrated across sites – creating islands of information and supporting varying levels of functionality.



The Future: Shared Data, Knowledge, and Logic

Future clinical applications will take advantage of shared repositories of enterprise data, knowledge, and logic, in a *services-oriented architecture*





Welcome to the KM portal!

Welcome

About Us

Overview

Launching KM Portal

Help

FAQ

Glossary

Download a Quick Reference guide in Word format

Announcements



We've changed!

With usability in mind, we recently underwent a redesign of our Knowledge Management portal. Alan Rose, usability expert in CIRD, has completed interface redesign for other Partners applications such as Patient Gateway and LMR to name a few. The Knowledge Management portal is almost a year old and we thought it would be the right time to implement usability improvements and provide our users with easier to use search interfaces.

What has changed? First, we upgraded our code to a .NET platform through the hard work of **Web Integration Team** and **PHS Web Development**. Second, we've improved our graphical interface and site layout, and we've added bread crumbs for improved taxonomy navigation. With filter based search, you will find you can refine your search within the same screen without having to use the back button. With keyword search, navigation between pages of search results is easier to use. These are just a few of the improvements you will find.

If you are visiting the site for the first time, please visit our getting started guide which provides an overview of search capability and functions. You can also review the Glossary of terms to familiarize yourself with our site's terms and terminology.

If you have feedback related to the site's redesign, please email Cathynn Harris at charris@partners.org who is coordinating the development, deployment efforts for this site.

This site is intended to help anyone at Partners who is engaged in embedding clinical knowledge into the various electronic health record systems share that knowledge with each other. Partners has a rich inventory of order sets, rules, reminders, expert dosing databases, drug information, and documentation templates embedded in a rich array of clinical systems. The Partners Knowledge Management Team has begun the process to inventory and catalogue these assets to support sharing and efficient maintenance.

You can access these assets in three ways:

[Keyword Search](#)

[Browse by Topic](#)

[Filter-based Search](#)

Site navigation is organized by the four key domains of the Partners Signature Initiatives: Quality, Safety, Disease Management, and Trend Management.

Filter-based search makes it possible to look at content comparatively. For example, if one would like to compare order sets for cardiac interventions at the Brigham and Women's Hospital and the Massachusetts General Hospital, then filter-based search is the simplest way to view information sifted for these attributes.

Alternatively, if one wants to see all the content related to managing anticoagulation, then navigating there from the Safety section of site navigation will be the simplest. For more information on this please go to "Getting Started". Our team will continue to catalogue and update in the upcoming years, particularly as more hospitals implement physician order entry systems and the LMR.

In addition, in 2005, we'll begin implementing specialized tools to support better collaboration with subject matter experts in content development as well as more efficient management of the tracking, versioning, and cataloguing needed for content management. We look forward to working with all of you to make this portal work for you.

If you are looking for content and cannot find it, or if you are having technical difficulty with the site, please contact the Help Desk at **617-732-5927** and open a ticket under the **KNOWLEDGE MANAGEMENT** queue, we'll be glad to help. Our hours of primary support are **8:30-4:30 Mon-Friday**.

Compare Content Across Organizations



Keyword search →

Site Search:

[Home](#)

[Browse by Topic](#)

[Filter-based Search](#)

Search Criteria

Clinical Disciplines

All Clinical Disciplines
Anesthesiology/Perioperative Medicine
Behavioral Medicine
Burn Management
Cardiology (Interventional)
Cardiology (Medical)
Cardiology (Surgical)
Emergency Medicine
Endocrinology
Gastroenterology
General Medicine
General Surgery
GI Colorectal Surgery
Hematology and Oncology
Infectious Disease
Nephrology
Neurology
Neurosurgery
Newborn/Neonatology
Obstetrics and Gynecology
Orthopedic

Filters

Entity :

All Entities
BWH
DFCI

Venue :

Acute Care
All Venues
Ambulatory Care

Patient Age Group :

Adult
All Patient Age Groups
Geriatric

Application :

All Applications
BICS Event Monitor
BICS Order Entry

CTRL - click to select multiple choices from the filters

Content Type :

All Content Types
Drug Information
Expert Dosing

Patient Safety :

Alerts and Notification
All Patient Safety
Consequent Order/Lab Display

Disease Management :

All Disease Management
Coronary Artery Disease
Diabetes

Results

Document Title	Content Type	Entity	Selected Search Filters:
Aortic Surgery Post Op Pathway - BWH View Details	Order Sets and Templates	BWH	Clinical Disciplines
Atrial Fibrillation Protocol - MGH View Details	Order Sets and Templates	MGH	• Cardiology (Surgical)
Cardiac SICU Additional Post Op Orders Transplant Patients - MGH View Details	Order Sets and Templates	MGH	Entity
Cardiac Surgery Admission Pre-Op - BWH View Details	Order Sets and Templates	BWH	• BWH
Cardiac Surgery Admission Pre-Op - MGH View Details	Order Sets and Templates	MGH	• MGH
Cardiac Surgery Ellison 8 Front Door Same Day Admit - MGH	Order Sets and Templates	MGH	Venue
			• All Venues
			Patient Age Group
			• All Patient Age Groups
			Application
			• All Applications
			Content Type

IBUPROFEN - Microsoft Internet Explorer provided by Partners HealthCare System

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Media Print Copy Paste

Address https://e7.documentum.com/eRoom/USEAST3/ClinicalContentUpdate/0_8b72 Links

Adobe Y! Search Web Bookmarks My Yahoo! Yahoo! Finance Mail News Shopping Entertainment

EMC documentum eRoom

My eRooms > Partners Gerios v2 > NSAIDs and COX-2 inhibitors > NSAIDs database > IBUPROFEN

map search tasks X

Partners Gerios v2

- Cardiac Meds
- eRoom EXperience To Date
- General Articles
 - Inappropriate Medication Administration to the Acutely Ill Elderly.doc
- Gerios v2 eRoom Inbox
- Narcotics
- NSAIDs and COX-2 inhibitors
 - 31.pdf
- COX-2 INHIBITOR INFORMATION
 - General questions for NSAIDs
 - NSAIDs by therapeutic class.doc
- NSAIDs database
 - DICLOFENAC SODIUM
 - IBUPROFEN**
 - IBUPROFEN
 - INDOMETHACIN
 - INDOMETHACIN SUSTAINED RELEASE
 - PIROXICAM
 - SULINDAC
 - NAPROXEN
 - KETOROLAC TROMETHAMINE
 - CELECOXIB
 - ROFECOXIB
 - VALDECOXIB

IBUPROFEN

a database entry created by Saverio Maviglia on 10 Sep 04

next previous summary

Rollup Name	IBUPROFEN
Route	PO
Lexicomp Reference	...Use lowest effective dose for shortest period possible...
Current BICS FQC	Q6H, PRN
Current BICS Min.Dose	200 MG
Current BICS Max.Dose	800 MG
Current BICS Prf.Dose	400 MG
Current BICS Substitute Meds	
Current BICS Message	
Proposed Gerios FQC	Q8h
Proposed Gerios Min.Dose	200 MG
Proposed Gerios Max.Dose	800 MG
Proposed Gerios Prf.Dose	400 MG
Proposed Gerios Substitute Meds	
Proposed Gerios Message	

Comments

Suggest regular, not prn, treatment for 5-7 days and then re-evaluate. (Claus Hamann , Partners Healthcare , 30 Sep 04 10:29am)

Agree (Jatin Dave , 30 Sep 04 11:21pm)

Round 1 Summary (Oct 18) (Eileen Yoshida , Partners Healthcare , 18 Oct 04 4:00pm)

- Agreement on min dose, max dose and preferred (default) dose.
- Re: frequency - suggestion made to change to q6h (NOT q6h prn) for better pain management. In addition, in LWR, we technically, we default to prn dosing, therefore, must use q6h.

I would like to see max dose at 600mg (James Rudolph , 26 Oct 04 8:51pm)

However, I can be easily persuaded to keep it at 800.

Ibuprofen (Andrew Seger , 29 Oct 04 8:55am)

Default Dose = 400 mg every 6 hours; current labeling says max is 3200 mg daily ;
max dose = 800 mg max frequency= Q6H = 2400 mg QD

Round 2 Summary (Nov 14) (Eileen Yoshida , Partners Healthcare , 15 Nov 04 10:56am)

- Still need to finalize max dose of ibuprofen
- I will try to pull (and post) Ann Rheum Dis 2004 reference to see if this is helpful

Secure Clinical Communication And Notification of Results

Automatic Reminders

Summary Flowsheets

Intuitive Chart Summary

Coded Clinical Data

Customizable Desktop

LMR QMA4 SUMMARY - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search

Google

Test,Test

16733339 (BWH)

Select Desktop Pt Chart: Summary Oncology Custom Reports Admin Sign Results ? Resource Popup

Reminders

- Patient age 18-49 with chronic medical condition, recommend influenza vaccination.

To Do

Problem

101.1 F*

09/14/2003

Patient Journal

Patient E-mail

BCONNER@PARTNERS.ORG

Medications

Add New

Accutane (ISOTRETINOIN) 10MG CAPSULE take 1 Capsule(s) PO Q12H x 30 days

Amlodipine 2.5 MG (2.5MG TABLET take 1) PO QD

Atenolol 25 MG (50MG TABLET take 0.5) PO QD

Combivir 1 TAB BID x 30 days

Efavirenz 600MG TABLET take 1 Tablet(s) PO QHS

Lipitor (ATORVASTATIN) 40 MG (40MG TABLET take 1) PO QAM

Ms CONTIN (MORPHINE CONTROLLED RELEASE) Variable (30MG TABLET SA MG

Nevirapine 200MG TABLET take 1 Tablet(s) PO BID

Prozac (FLUOXETINE HCL) 20 MG (20MG TABLET take 1) PO QD x 30 days

Synalar 0.025% CREAM (FLUOCINOLONE 0.025% CREAM) 1 APPLICATION (0.

Allergies

Add New

Allergen Reaction

CEFUROXIME AXETIL - Rash

CEFOTAXIME SODIUM - Hives

Health Maintenance

HM Item Date of Last Result

HCV Ab

test alpha

test HM

Influenza Vaccine 12/17/2003

Viral load

Breast Exam

Cholesterol 09/20/2006 Patient refuses

Mammogram

Pap Smear

Pneumovax

Smoking status

PPD

Hep B Vaccine

Social Service Ref

HBsAB

HCV

Td Booster

Hep A Vaccine

CMV IgG

Triglycerides

Advance Directives

Notes

Add New

Date Subject Provider

04/14/2006 Hospital Clinic Visits Sherilyn Levy

04/12/2006 Hospital Clinic Visits Noreen Fitzgerald,RN

04/12/2006 Hospital Clinic Visits Maureen E. Ward

04/12/2006 Hospital Clinic Visits Pamela Whitney

04/12/2006 Hospital Clinic Visits Claire R. Collins

04/12/2006 Hospital Clinic Visits Taylor Toomey,RN

04/12/2006 Hospital Clinic Visits Taylor Toomey,RN

04/12/2006 Hospital Clinic Visits Loice Johnson White

04/12/2006 Hospital Clinic Visits Jeannette Simpson

04/12/2006 Hospital Clinic Visits Patricia A Roman

07/25/2005 Line Placement Cassandra M Earley

07/07/2005 Est/Proc

07/07/2005 Asthma

11/26/2003 Patient

09/23/2003 Patient

09/14/2003 Transc

07/03/2003 Patient Note Paul Edward Sax, M.D.

07/02/2003 Office Note Paul Edward Sax, M.D.

05/27/2003 Note Carol Levine

05/01/2001 Patient Note Karen L. O'Rourke

Immunization

Social History

Physicians

Add New

Name Service Specialty

09/25/2006 N/A CLARK,RACHAEL A.,M.D.,PH.D. DERM

09/25/2006 N/A AYANIAN,JOHN ZAVEN,M.D. BIMA

09/21/2006 N/A ADAMS,MIMI DERM

08/30/2005 N/A PUTMAN,MELISSA S,M.D. BIMA

12/01/2004 10:30 GERHARD-HERMAN,MARIE DENISE,M.D. BSG

07/21/2004 10:30 BROOKS,DAVID C,M.D. BSG

04/27/2004 14:00 GERHARD-HERMAN,MARIE DENISE,M.D. BSG

04/27/2004 14:00 GERHARD-HERMAN,MARIE DENISE,M.D. BSG

09/15/2003 09:30 BUDSON,ANDREW ETHAN,M.D. 221 BRIGHAM MEDICAL

11/12/2002 N/A HURLEY,BEN SOCIAL SERVICES

CVS PHARMACY #2454

Patient M/A List

Customize

Sticky Notes

Add New

SFQD R&D Team

Acknowledgements

- **Clinical Investigators**

- Jeff Linder, MD, MPH
- Jeff Schnipper, MD, MPH
- John Orav, PhD

- **Clinical Informatics**

- Jonathan Einbinder, MD, MPH
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- Alan Rose, MSc

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- Julie Fiskio
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- Lynn Volk, MA
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- Irene Galperin
- Nina Plaks
- Anatoly Postilnik
- Boris Rudelson
- Michael Vashevko

- **Clinical Systems Management**

- Lynn Klokman
- Eunice Jung

- **Other**

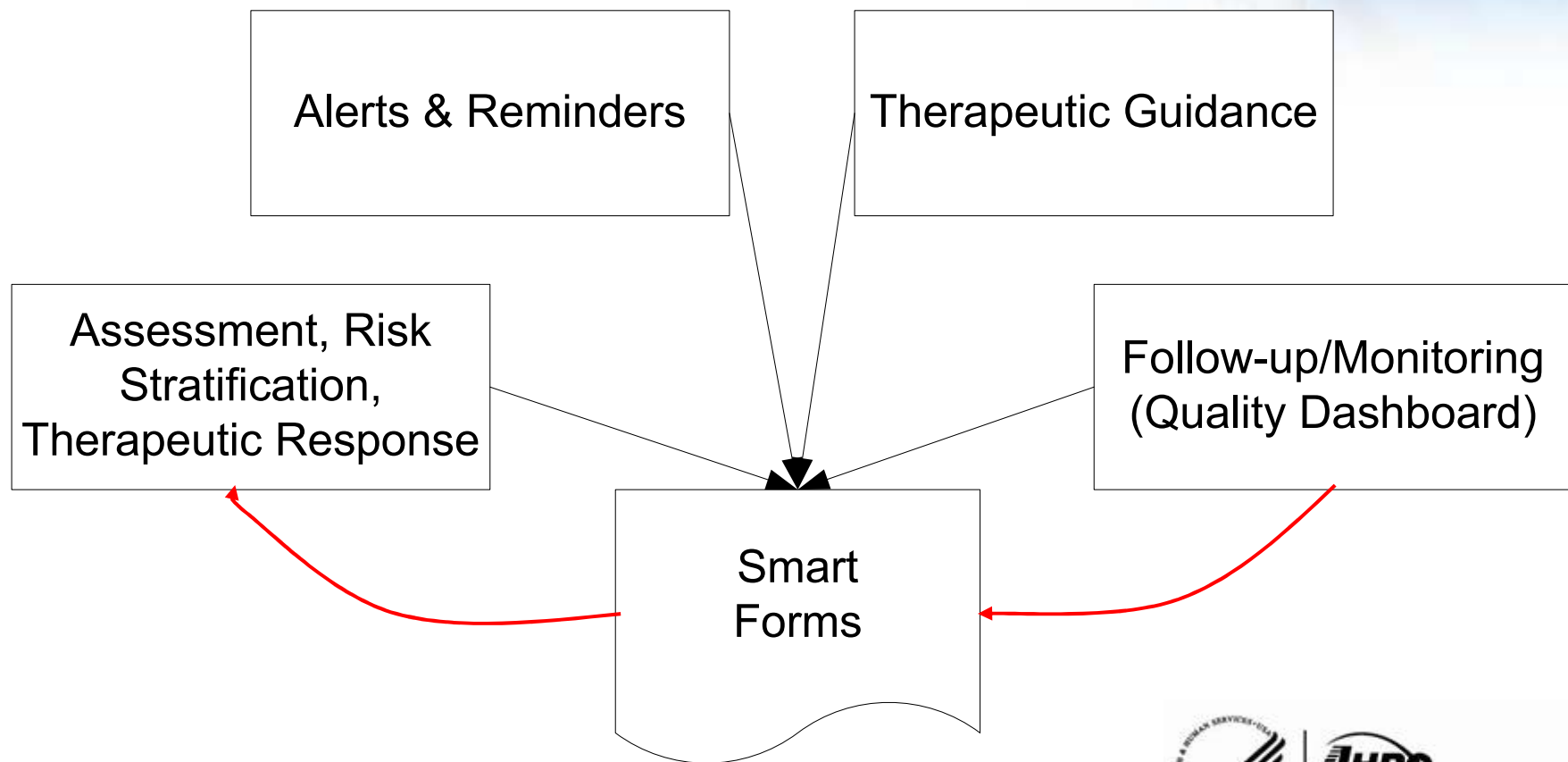
- Steve Flammini, CTO
- Joanne Tremblay
- Cindy Spurr
- Cindy Bero
- Liz Mort, MD
- Alan Cole, MD

AHRQ R01HS015169
Blackford Middleton, PI



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CDSS Integrated into the Clinical Workflow



Interaction between data, analysis, and user:

- *User of data is creator of data*
- *Data is collected as a by-product of routine care*
- *Analysis occurs within the information environment*
- *Analytic results are delivered to the provider during routine care*

*Henry SB, Lenert L, Partridge R, Middleton B.
Proc HIMSS Ann Conf. 1993;57-81.*



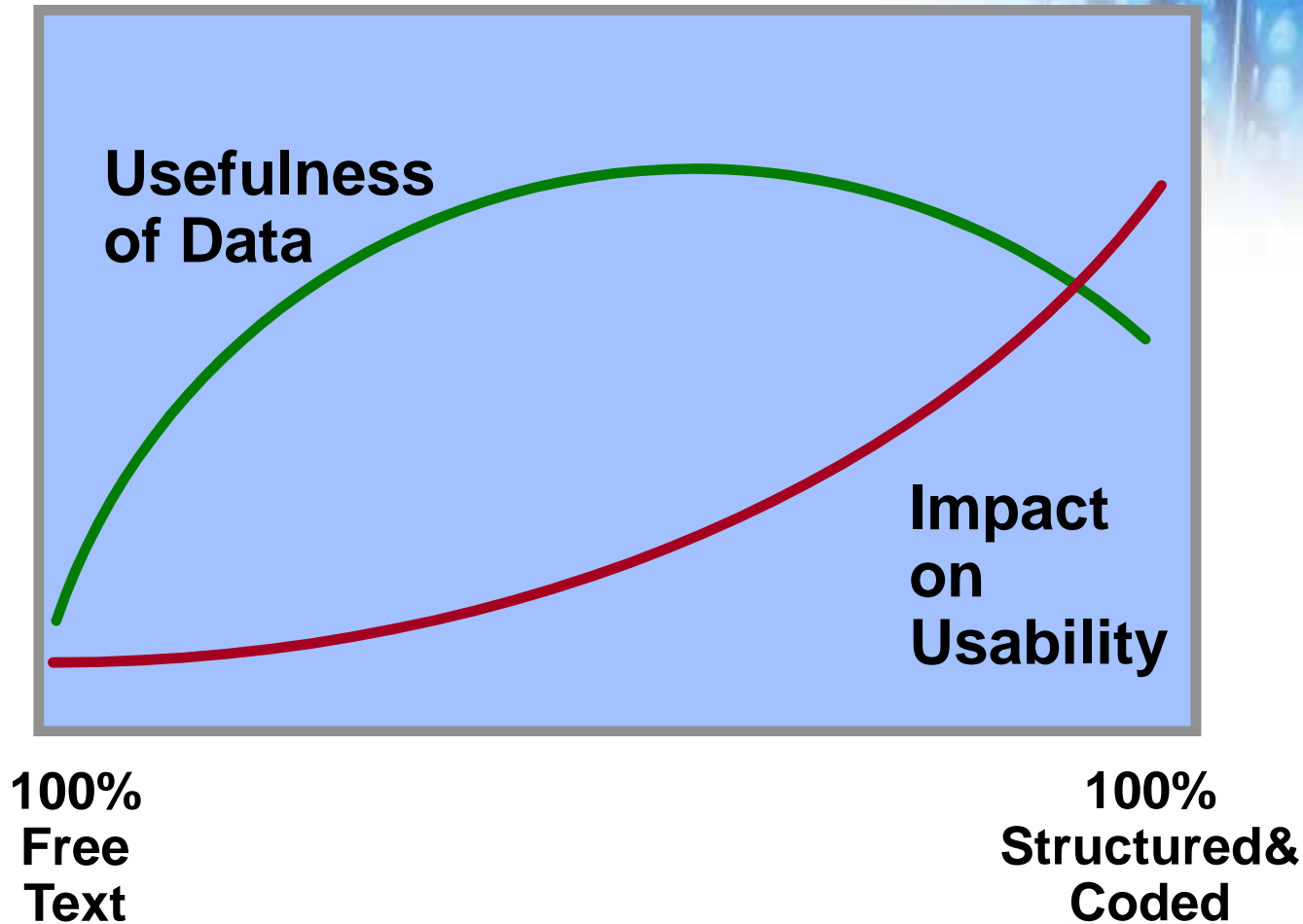
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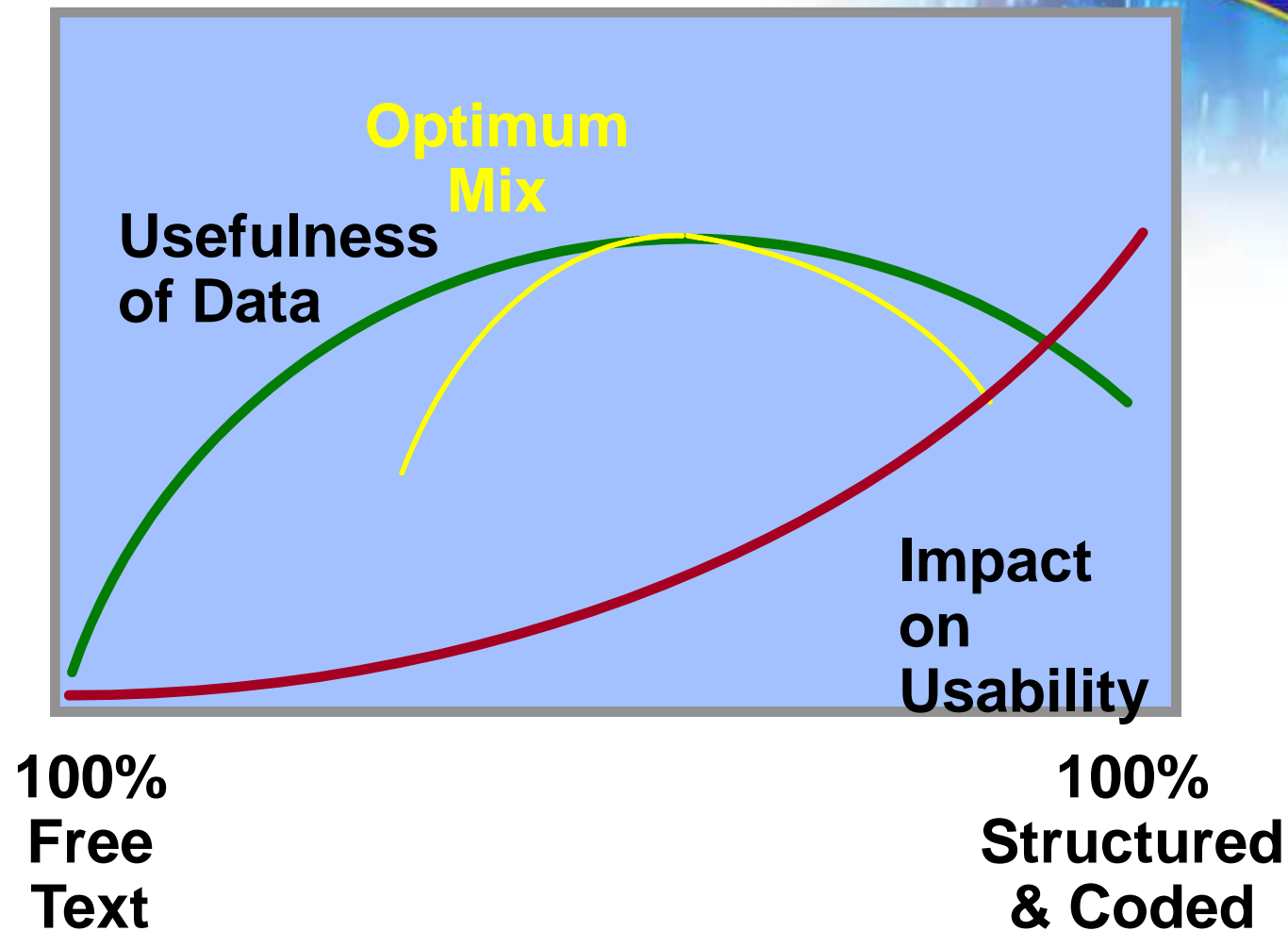
**Captain, let me
make something
clear to you:
I'm a doctor,
not a !&#\$%!
computer operator.**



Structured vs. Unstructured Data



Structured vs. Unstructured Data



Middleton B, Renner K, Leavitt MK. Ambulatory Practice Clinical Information Management: Problems and Prospects
J Hlth Info Mgmt, 11;4:97-112, 1997



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SFQD Project Goals

- To develop common framework and approach to integrating improved clinical documentation with decision support in the LMR
 - Primary method will be through use of “Smart Forms”
 - Secondary method will be through use of “Quality Dashboards”



SFQD Secondary Goals

- To externalize knowledge elements and logic used in LMR smart forms, alerts & reminders, and quality dashboards
- To make use of external rules engine for all LMR clinical inference and decision support
- To improve usability of LMR (market competitiveness)

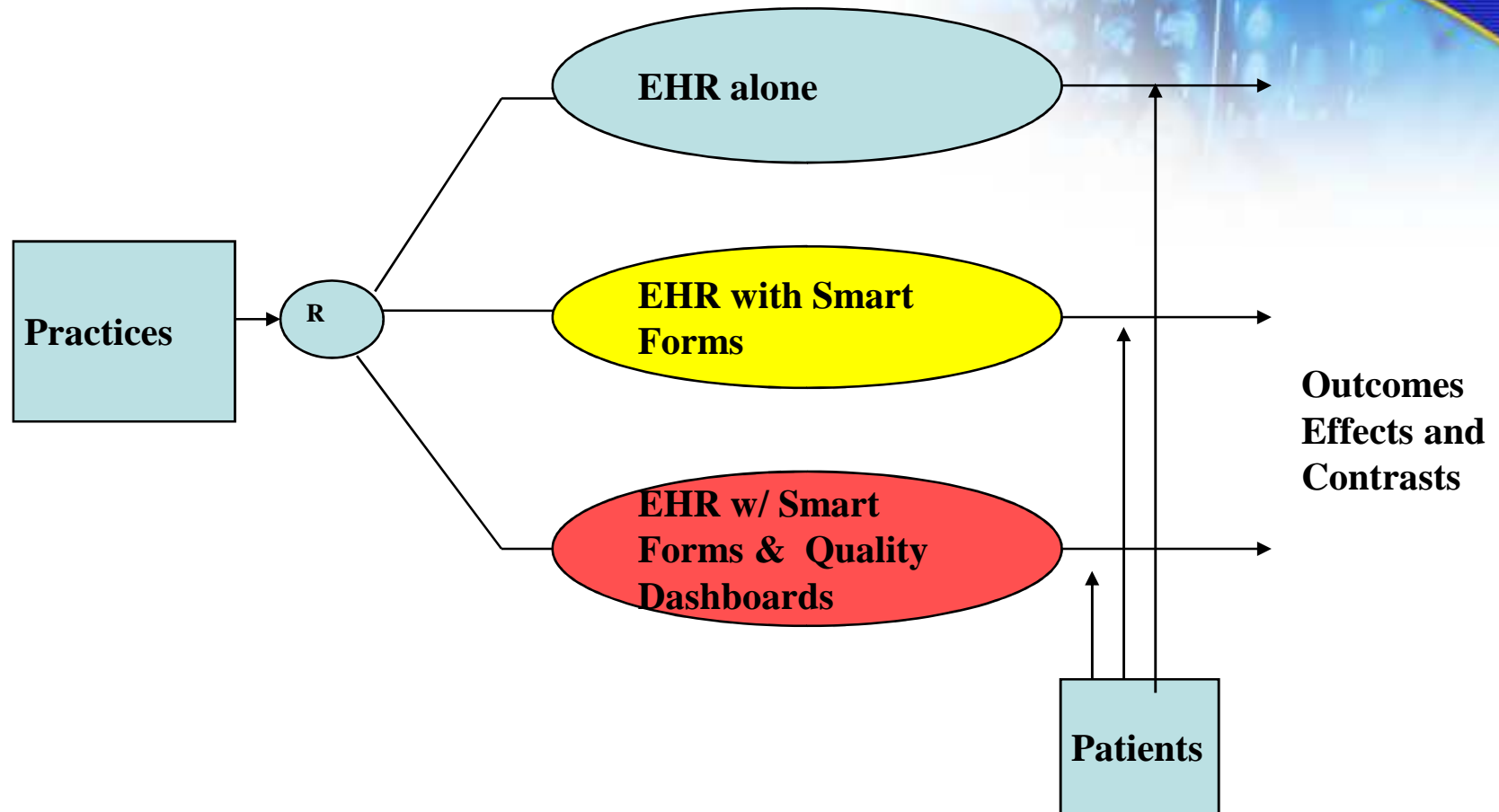


SFQD Specific Aims

- Specific Aim 1: To design and implement an **integrated documentation-based clinical decision support and physician feedback system**, provided in an electronic health record (EHR), to improve the management of patients with acute and chronic medical conditions.
- Specific Aim 2: To determine the **effectiveness of documentation-based CDSS and physician feedback** on documentation and the clinical management of patients with coronary artery disease and acute respiratory tract infections.
- Specific Aim 3: To assess the **perceived value** of EHR quality dashboards by clinicians and their marginal impact over smart forms on compliance with best practices in ARI and CAD.



Research Design



Condition Dichotomy

- ARI
 - Acute condition
 - Errors of commission
 - Often a stand-alone urgent care visit
 - Decision support during visit only
- CAD & DM
 - Chronic conditions
 - Errors of omission
 - Usually in context of a full visit with multiple problems
 - Decision support before, during, and after visit

Limited Time

Competing Demands



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What is a Smart Form?

- Clinical documentation-based
- Actively engage user during workflow
- Organize relevant data
- Request new data
- Integrate decision support, ordering, patient education, and documentation



ARI Smart Form Features

- Structured data entry
- Patient data display
- Diagnosis detection
- Presentation of treatment options with integrated decision support
 - Based on coded data and final diagnosis (e.g., probability of strep throat)
- Printing of patient handouts
- Access to medical literature



ARI Smart Form

Navigation

Internet Explorer provided by Partners

Documentation

Orders and Plan

02/12/1956 (50 yrs.)

Summary

Note Preview

Orders/Plan

Show/Hide All

Chief Complaint

▲

Orders/Plan

CC

Chief Complaint: Sore throat

Symptoms

Symptoms

☐ ☐ ☐

“All Normal” Check box

Comments

<input checked="" type="checkbox"/>	<input type="checkbox"/>	Documented fever: <input type="text"/> max (°F)	<input type="text"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Subjective fever	<input type="text"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Chills or feeling cold	<input type="text"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Fatigue, tired, worn-out	"Wiped out"

<input checked="" type="checkbox"/>	<input type="checkbox"/>	Headache	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Facial or sinus pain	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Facial or sinus pressure	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Runny nose/nasal discharge	<input type="text"/>
<input type="checkbox"/>	<input type="checkbox"/>	- Colored nasal discharge	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Post-nasal drip	<input type="text"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Sore throat	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Swollen glands	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Shortness of breath	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Wheezing	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Pleuritic chest pain	<input type="text"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cough	<input type="text"/>
<input type="checkbox"/>	<input type="checkbox"/>	- Productive cough (sputum or phlegm)	<input type="text"/>
<input type="checkbox"/>	<input type="checkbox"/>	- Cough productive of colored sputum	<input type="text"/>
<input type="checkbox"/>	<input type="checkbox"/>	- Non-productive cough	<input type="text"/>

Rapid capture of clinical information with drop down lists and check boxes

Save and Exit

Save as Final and Exit

[Send ARI Smart Form Feedback](#)



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ARI Smart Form

ARI Smart Form - Microsoft Internet Explorer provided by Partners HealthCare System

Oettest,Edwina 11489994 (BWH) 02/12/1956 (50 yrs.) F

PARTNERS ARI Smart Form ?

☒ Rash

☐ Muscle aches

Other:

She is very concerned she has strep throat.

Free text fields

Is patient in job with high risk of transmitting strep throat? Yes ☒ No ☐

Patient's primary goal in seeking care:
Get antibiotics

Sick contacts? Yes ☒ No ☐

Remedies

Y	N	Remedies	Comments
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Analgesics/antipyretics	Effective? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cough remedies	Effective? Yes <input type="checkbox"/> No <input type="checkbox"/>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Antibiotics	Effective? Yes <input type="checkbox"/> No <input type="checkbox"/>

Other remedies tried:

Problems

Borderline hypertension testing	11/10/26/2006
RSK Rotator cuff tendonitis	10/18/2006
Tonsillectomy	10/18/2006
Ankle pain	10/17/2006
Appendectomy	10/17/2006
Cough	10/12/2006

Save and Exit Save as Final and Exit

Send ARI Smart Form Feedback

Research and Quality
Health Care • www.ahrq.gov

Automatic importation of
problems, allergies,
medications, and vital signs

ARI Smart Form

ARI Smart Form - Microsoft Internet Explorer provided by Partners HealthCare System

Oetest,Edwina 11489994 (BWH)

Automatic conversion to free text

Oetest,Edwina
11489994 (BWH)
02/12/1956 (50 yrs.) F

CHIEF COMPLAINT
Patient presents with a chief complaint of sore throat for 3 days.

SYMPTOMS
Patient complains of subjective fever, chills or feeling cold, feeling fatigued, tired, worn-out ("Wiped out") and sore throat.

Patient denies documented fever, ear pain, ear stuffiness, red or itchy eyes, headache, facial or sinus pain, facial or sinus pressure, runny nose/nasal discharge, post-nasal drip, swollen glands, shortness of breath, wheezing, pleuritic chest pain, cough, rash or muscle aches.

Other: She is very concerned she has strep throat..

HPI
Overall clinical course is worsening. The illness has caused the patient to restrict their activities. The patient is in a job with high risk of transmitting strep throat. Patient's primary goal in seeking care is to get antibiotics. The patient has sick contacts

REMEDIES
Patient reports trying cough remedies. Patient reports trying analgesics/antipyretics, which were not effective. Patient reports not trying antibiotics.

PROBLEMS
Borderline hypertension (11/01/2006)
testing (10/26/2006)
RSK Rotator cuff tendonitis (10/18/2006)
Tonsillectomy (10/18/2006)
Ankle pain (10/17/2006)
Appendectomy (10/17/2006)
Cough (10/12/2006)
Graves'disease (10/10/2006)

Save as Final and Exit

Send ARI Smart Form Feedback

ARI Smart Form

Decision support: diagnosis

ARI Smart Form - Microsoft Internet Explorer provided by Partners HealthCare System

Oetest,Edwina 11489994 (BWH) 02/12/1956 (50 yrs.) F

Summary Note Preview

Show/Hide All

CC

Symptoms

HPI

Remedies

Problems

Allergies

Meds

Smoking

Recent Test Results

Test	Comments
Chest x-ray	
Streptococcal culture	
Influenza test	

Diagnosis selection leads to diagnosis-appropriate order set

Diagnoses

1 ^o	2 ^o	Diagnosis
<input type="radio"/>	<input type="checkbox"/>	Non-specific URI
<input type="radio"/>	<input type="checkbox"/>	Otitis media
<input type="radio"/>	<input type="checkbox"/>	Non-streptococcal pharyngitis
<input checked="" type="radio"/>	<input type="checkbox"/>	Streptococcal pharyngitis
<input type="radio"/>	<input type="checkbox"/>	Sinusitis
<input type="radio"/>	<input type="checkbox"/>	Acute cough/acute bronchitis
<input type="radio"/>	<input type="checkbox"/>	Viral syndrome
<input type="radio"/>	<input type="checkbox"/>	Influenza
<input type="radio"/>	<input type="checkbox"/>	Pneumonia
<input type="radio"/>	<input type="checkbox"/>	Other: <input type="text"/>

Orders/Plan

Strep Throat Probability

Strep Throat Criteria: 4 out of 4 [\(How calculated\)](#)

1

Current Probability: 41% for strep throat

Prescribe Medications

Antibiotics

The drug of choice of strep throat

☐ Penicillin 500 mg po bid x 10 days

The drug of choice of strep throat for penicillin-allergic patients

☐ Erythromycin 500 mg po bid x 10 days

[Prescribe Other Antibiotics](#)

Recommend OTC Medications

Analgesics & Antipyretics

☐ Ibuprofen

☐ Acetaminophen

☐ Lozenges

☐ Sprays

Combination Products

[Feedback](#)

and Quality

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ARI Smart Form

ARI Smart Form - Microsoft Internet Explorer provided by Partners HealthCare System

Oetest,Edwina 11489994 (BWH) 02/12/1956 (50 yrs.) F

Summary **Note Preview**

Show/Hide All

CC

Symptoms

HPI

Remedies

Problems

Allergies

Meds

Smoking

ROS

PE

Results

Dx

Recent Test Results

Test

Chest x-ray

Streptococcal culture

Influenza test

Rapid strep test

Negative ☒ Positive ☐

Other recent test results:

Diagnoses

1 ^o	2 ^o	
<input type="radio"/>	<input type="checkbox"/>	Non-specific
<input type="radio"/>	<input type="checkbox"/>	Otitis media
<input type="radio"/>	<input type="checkbox"/>	Non-streptococcal pharyngitis
<input checked="" type="radio"/>	<input checked="" type="checkbox"/>	Streptococcal pharyngitis
<input type="radio"/>	<input type="checkbox"/>	Sinusitis
<input type="radio"/>	<input type="checkbox"/>	Acute cough/acute bronchitis
<input type="radio"/>	<input type="checkbox"/>	Viral syndrome
<input type="radio"/>	<input type="checkbox"/>	Influenza
<input type="radio"/>	<input type="checkbox"/>	Pneumonia
<input type="radio"/>	<input type="checkbox"/>	Other:

Assessment:

Antibiotics

The drug of choice of strep throat

☒ Penicillin 500 mg po bid x 10 days

The drug of choice of strep throat for penicillin-allergic patients

☐ Erythromycin 500 mg po bid x 10 days

[Prescribe Other Antibiotics](#)

Recommend OTC Medications

Analgesics & Antipyretics

☒ Ibuprofen

☐ Acetaminophen

☐ Lozenges

☐ Sprays

Combination Products

☐ Nighttime combination product (e.g., Nyquil)

Recommend

☒ Fluids and rest

☒ Salt water gargles

☒ Call if symptoms worsen, new symptoms arise, or symptoms fail to improve after a total of 14 days

Print

☒ Patient handout about streptococcal pharyngitis

☒ Excuse from work note: May return to work in 4 days

Other Plan:

Save and Exit **Save as Final and Exit**

[Send ARI Smart Form Feedback](#)

Rapid order selection

Automatic documentation

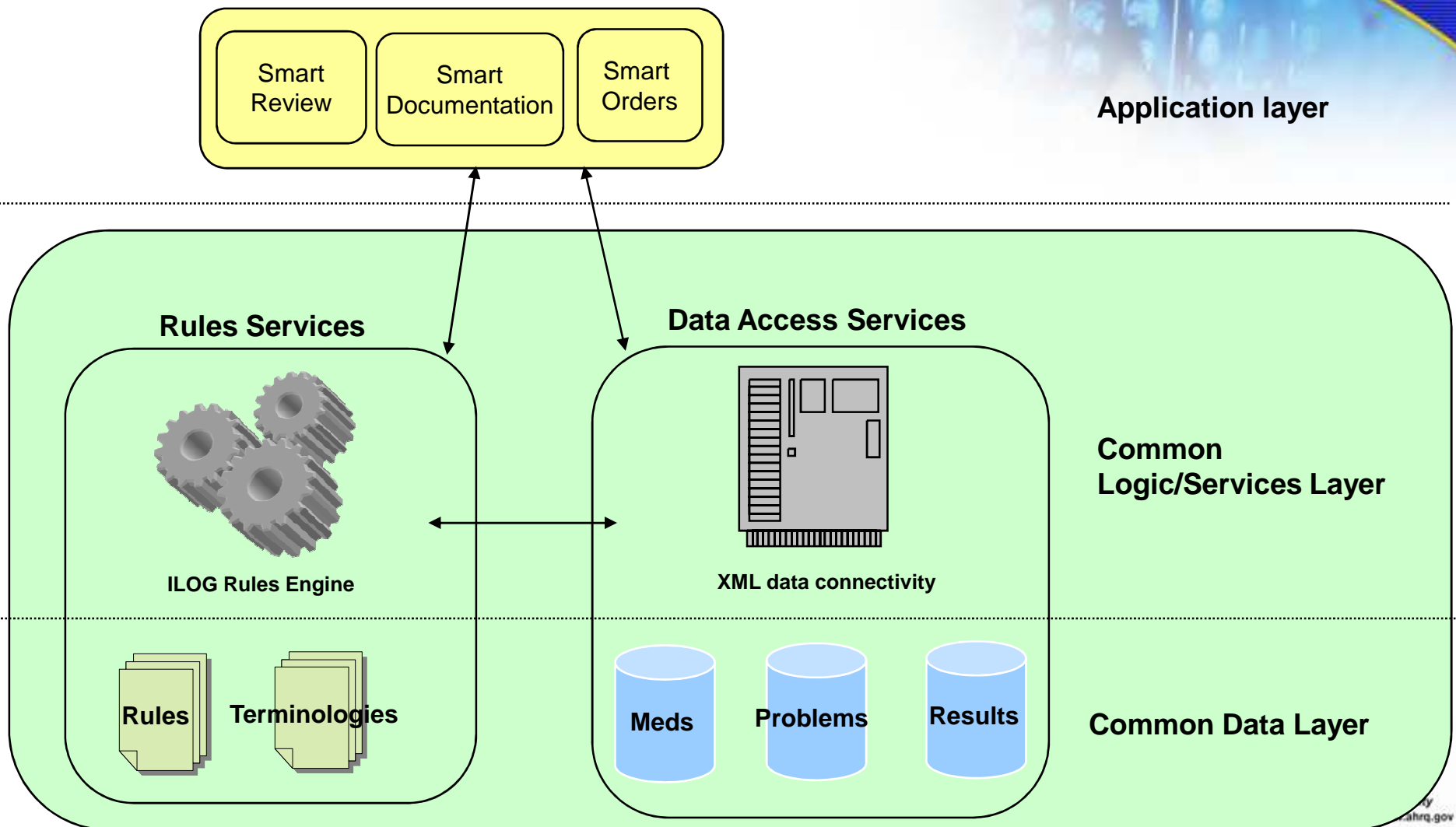
Workflow complete

CAD / Diabetes Smart Form

- Integrated into a full visit note
- Customized views tailored to medical condition(s) of the patient
- Central note-writing section
 - Multiple ways to document a note
 - “Formlets” for selected coded data entry
- Decision support section
- Patient View
 - Activates patient around goals of care



Smart Forms – a composite application, based on SOA



CAD/DM Smart Form

Smart View:
Data Display

Documentation
Window

Assessment,
Orders, and Plan

Assessment and recommendations
generated from rules engine

- Lipids
- Anti-platelet therapy
- Blood pressure
- Glucose control
- Microalbuminuria
- Immunizations
- Smoking
- Weight
- Eye and foot examinations

Assessment

No recent LDL measurement

Patient is on anti-platelet therapy

Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)

Patient is due for Pneumovax (older than 65, no record of prior vaccination)

Patient is due for Influenza Vaccine (high risk medical condition)

Patient may be Current Smoker, not thinking of quitting. Last counseled on 10/10/06.

Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

CAD/DM Smart Form

Lnrsflet,Cadfive

20567889 (BWH) 01/01/1931 (75 yrs.) M

Log RCT Select Desktop Pt Chart: Smart Form Oncology Custom Reports Admin Sign Results ? Resource

Vital Signs

	10/31/06	10/10/06	03/06/06
T (<98.6)		98.5F	
BP (<130/80)	150/75!	110/85!	110/75
HR (50-100)	70	85	
RR	14		
O2 Sat			
WV	200lb		165lb
H	72in		
BMI (<25)	27.1!		22.4

Rules

If patient has DM then goal BP < 130/80

If the average of the blood pressure at the last 2 visits (in the last year) is above goal then return..

Procedures ☒ None listed

Save & Exit Save as Final & Exit Exit

Orders: A/P

Assessment

- No recent LDL measurement
- Patient is on anti-platelet therapy
- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Patient is due for Pneumovax (older than 65, no record of prior vaccination)
- Patient is due for Influenza Vaccine (high risk medical condition)
- Patient may be Current Smoker, not thinking of quitting. Last counsel date is 10/10/06.
- Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

Lipid Management ☐

Antiplatelet Therapy ☐

Blood Pressure Management ☐

Immunizations ☐

Smoking ☐

Weight/BMI ☐

Follow-ups ☐

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CAD/DM Smart Form

Lmrsftest,Cadfive

20567889 (BWH) 01/01/1931 (75 yrs.) M

Log RCT Select Desktop Pt Chart: Smart Form Oncology Custom Reports

SmartView

Filter by

☒ CAD ☒ DM ☒ Smoking

Detected: CAD,DM,Smoking

Vital Signs

	10/31/06	10/10/06	03/06/06
T (<98.6)	98.5F		
BP (<130/80)	150/75	110/85	110/75
HR (50-100)	70	85	
RR	14		
O2 Sat			
Wt	200lb		165lb
H	72in		
BMI (<25)	27.1		22.4

Lab Tests Last Known

K Creatinine BUN Glucose HbA1c (4.4-6.4)

Medication Orders

Lab Orders

Referrals

Handouts/Education

Save & Exit Save as Final & Exit

Blood Pressure Management

Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)

[Start an Other Anti-Hypertensives \(Help Me Choose\)](#)

[Adjust Oretic 25 MG \(25MG TABLET take 1\) PO QD](#)

[Adjust Lisinopril 20 MG \(20MG TABLET take 1\) PO QD](#)

[Adjust Acebutolol HCL 200 MG \(200MG CAPSULE take 1\) PO QD](#)

☐ Order Chem 7 now

☐ Order Chem 7 in 4 Weeks

☐ Referral to Nutritionist

☐ Referral to Cardiac Rehab [\(Help Me Choose\)](#)

☐ Referral to Blood Pressure Specialist [\(Help Me Choose\)](#)

☐ [Print "Control High Blood Pressure"](#)

☐ [Print DASH diet instructions](#)

☐ [Print exercise "prescription"](#)

Oetest, George Herbert Walker 10/01/1921 (84 y) BM949 3/3

11489887 (BWH)

MedListSelector -- Web Page Dialog

SmartView Filter by

Help

Basic Variable Alternate

Allergies

Sulfa - Rash, Itching

ATENOLOL 50MG TABLET

Sig: 1 TABLET (50 MG) PO QD

Dose	Strength & Form, Take	Frequency
<input type="radio"/> 25 MG	25MG TABLET take 1	QD
<input checked="" type="radio"/> 50 MG	50MG TABLET take 1	QD
<input type="radio"/> 75 MG	25MG TABLET take 3	QD
<input type="radio"/> 100 MG	100MG TABLET take 1	QD
<input type="radio"/> 150 MG	50MG TABLET take 3	QD

PRN: ☐ Patient Educated ☒ No Substitutes ☒ Expire

Duration: 30 day(s)

Dispense: 30 Tablet(s)

Refills: 3

Start Date: 05/10/2006

End Date: 06/09/2006

Special Instructions

Comments (This will not print on prescription)

Add to ☐ My ☐ Practice Favorites as: ATENOLOL 50 MG PO QD 30 day(s) ☒ Rx Print/Fax ☐ no Rx

Ok Ok-Add New Cancel

http://ppd.partners.org/mar/test/popup/ModalLauncher.html?http%3A//ppd.partners.org/scripts/phsweb.m

CAD/DM Smart Form

Blood Pressure Management

Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)

[Add Other Anti-Hypertensives \(Help Choose\)](#)

Easy inclusion of assessment and orders into note

Assessment and Plan ☒

ASSESSMENT

- No recent LDL measurement
- Patient is on anti-platelet therapy
- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Patient is due for Pneumovax (older than 65, no record of prior vaccination)
- Patient is due for Influenza Vaccine (high risk medical condition)
- Patient may be Current Smoker, not thinking of quitting. Last counsel date is 10/10/06.
- Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

PLAN

Blood Pressure:

- Adjust Lisinopril 40 MG (40MG TABLET take 1) PO QD
- Order Chem 7 in 1 weeks
- Referral to Nutritionist
- Print "Control High Blood Pressure"

40 MG TABLET

400 MG (200MG

[\(Help Me](#)

e)

\$

"

MG TABLET

[essure"](#)

CAD/DM Smart Form: Workflow

Lnrsfett,Cadfive

20567889 (BWH) 01/01/1931 (75 yrs.) M

JAL31 3/3

BIMA

Log Select Desktop PLO... Custom Reports Admin Sign Results ? Resource Popup

Importation of data elements

Automatic inclusion of data (e.g., medications)

Subject: Routine Visit 11/1/2006

CAD DM Smoker

Problems **Procedures**

CAD-related

- Diabetes mellitus type 1 03/06/06
- Coronary artery disease 10/10/06

DM-related

- Diabetes mellitus type 1 03/06/06
- Coronary artery disease 10/10/06

Other

- Onychomycosis 10/10/06
- Elevated creatine phosphokinase 10/10/06

Beta-Blockers

- Acebutolol HCL 200 MG (200MG CAPSULE take 1) 10/10/06 PO QD

MG (325MG TABLET take 1) PO QD

ABLET take 1) PO QD

00MG CAPSULE take 1) PO QD

ications

ERO undefined

M CARBONATE 1500 MG (600 MG ELEM CA)/ VIT

MG (5MG TABLET take 1) GTUBE QD

s VIAL take 1) SC x1 x 30 days

L TABLETS (BISACODYL-PEG ELECTROLYTE PO X1 x 30 days

500 ML IV x1

LET take 1) PO QD

- Testolactone 250 MG (50MG TABLET take 5) JTUBE QID

Save & Exit Save as Final & Exit Exit

Orders, A/P

Execute

Assessment

- No recent LDL measurement
- Patient is on anti-platelet therapy
- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Patient is due for Pneumovax (older than 65, no record of prior vaccination)
- Patient is due for Influenza Vaccine (high risk medical condition)
- Patient may be Current Smoker, not thinking of quitting. Last counseled on 10/10/06.
- Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

Lipid Management

- No recent LDL measurement
- ☐ Order Lipid Panel now
- ☐ Order Lipid Panel With Direct LDL now
- ☐ Print instructions for fasting lipid panel
- ☐ Print outside lab request for fasting lipid panel

Antiplatelet Therapy

- Patient is on anti-platelet therapy

Blood Pressure Management

- Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
- Start an Other Anti-Hypertensives (Help Me Choose)
- Adjust Oretic 25 MG (25MG TABLET take 1) PO QD

CAD/DM Smart Form: Workflow

Lnrsfist,Cadfive

20567889 (BWH) 01/01/1931 (75 yrs.) M JAL31 3/3 BIMA

Log RCT Select Desktop Pt Chart: Smart Form Oncology Custom Reports Admin Sign Results ? Resource Popup

SmartView

Filter by
☒ CAD ☒ DM ☒ Smoker
 Detected: CAD,DM,Smoker

Problems Procedures

CAD-related
 Diabetes mellitus type 1 03/06/06
 Coronary artery disease

DM-related
 Diabetes mellitus type 1
 Coronary artery disease

Other
 Onychomycosis
 Elevated creatine phosphokinase

Meds Non-Meds

Anti-Hyperglycemic
Aspirin/Antiplatelet
 Acetylsalicylic ACID 325 MG (325MG TABLET take 1) PO QD

ACE-I/ARB
 Lisinopril 10 MG (10MG TABLET take 1) PO QD 10/31/06

Beta-Blockers
 Acebutolol HCL 200 MG (200MG CAPSULE take 1) PO QD 10/10/06

Note Graphs

Subject: Routine Visit 11/1/2006

- Dulcolax (BISACODYL) 5 MG (5MG TABLET take 1) GTUBE QD
- Glucagon HCL 1 MG (1MG VIAL take 1) SC x1 x 30 days
- Halflytely AND BISACODYL TABLETS (BISACODYL-PEG ELECTROLYTE SOLUTION) 1 TREATMENT PO X1 x 30 days
- Hetastarch 6% IN SALINE 500 ML IV x1
- Oretic 25 MG (25MG TABLET take 1) PO QD

--- select ---
 EXAM: Complete (female)
 EXAM: Hip/Knee/Ankle
 EXAM: Neck/shoulder
 EXAM: gyn
 EXAM: Back
 EXAM: full neuro
 EXAM: MMS

Assessment and Plan

Save & Exit Save as Final & Exit Exit

Orders, A/P

Execute Assessment

No recent LDL measurement
 Patient is on anti-platelet therapy
 Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
 Patient is due for Pneumovax (older than 65, no record of prior vaccination)
 Patient is due for Influenza Vaccine (high risk medical condition)
 Patient may be Current Smoker, not thinking of quitting. Last counseled on 10/10/06.
 Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)

Lipid Management
 No recent LDL measurement
☐ Order Lipid Panel now
☐ Order Lipid Panel With Direct LDL now
☐ Print instructions for fasting lipid panel
☐ Print outside lab request for fasting lipid panel

Antiplatelet Therapy
 Patient is on anti-platelet therapy

Blood Pressure Management
 Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)
[Start an Other Anti-Hypertensives \(Help Me Choose\)](#)
☒ Adjust Oretic 25 MG (25MG TABLET take 1) PO QD

CAD/DM Smart Form: Workflow

Formlets

Lmrsfjest,Cadfive
20567889 (BWH)

Log RCT Select

SmartView

Filter by
☒ CAD ☒ DM ☒ Sm
 Detected: CAD,DM,Smoker

Problems Procedures

CAD-related
☒ Diabetes mellitus type 1
☒ Coronary artery disease

DM-related
☒ Diabetes mellitus type 1
☒ Coronary artery disease

Other
☒ Onychomycosis
☒ Elevated creatine phosphokinase

Meds Non-Meds

Anti-Hyperglycemic
Aspirin/Antiplatelet
 Acetylsalicylic ACID 325 MG (325MG TABLET take 1) PO QD

ACE-I/ARB
☒ Lisinopril 10 MG (10MG TABLET take 1) PO QD

Beta-Blockers
☒ Acebutolol HCL 200 MG (200MG CAPSULE take 1) PO QD

Physical Examination

HEENT		Comment
<input type="checkbox"/>	Extraocular movements	
<input type="checkbox"/>	Pupils	
<input type="checkbox"/>	Sclera	
<input type="checkbox"/>	Conjunctiva	
<input type="checkbox"/>	Oropharynx	
Neck		Comment
<input type="checkbox"/>	Neck exam	
<input type="checkbox"/>	Lymphadenopathy	
Lung		Comment
<input type="checkbox"/>	Lung auscultation	
Heart		Comment
<input type="checkbox"/>	Rate and rhythm	

OK Cancel

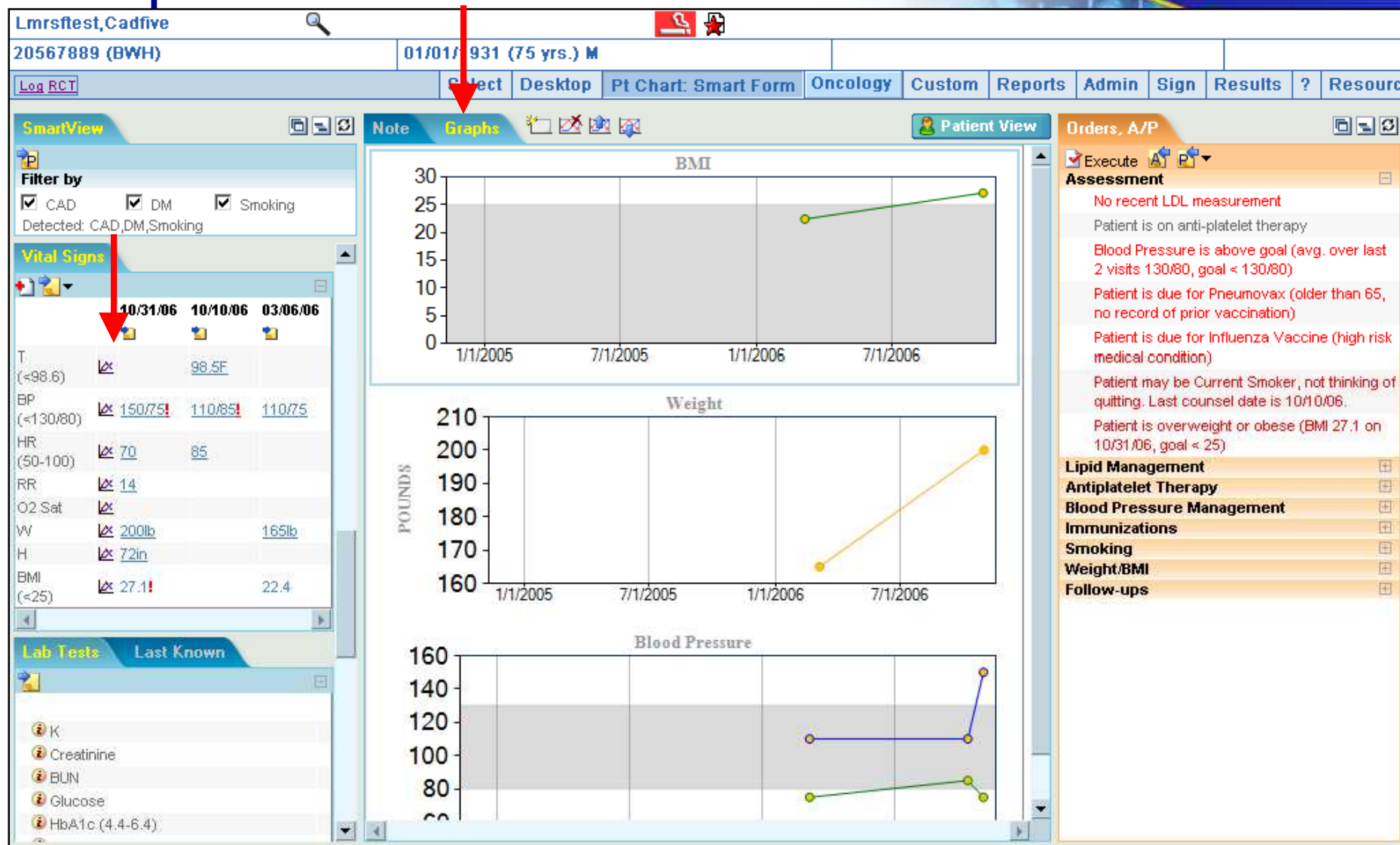
http://smartformsintra.partners.org Internet

Save & Exit Save as Final & Exit Exit

Popup

LDL measurement
 In anti-platelet therapy
 Sure is above goal (avg. over
 > 130/80, goal < 130/80)
 Due for Pneumovax (older than
 1 year or prior vaccination)
 Due for Influenza Vaccine (high
 risk condition)
 May be Current Smoker, not
 quitting. Last counseled on
 11/1/04
 Overweight or obese (BMI 27.1
 6, goal < 25)
ment
 LDL measurement
 Panel now
 Panel With Direct LDL now
 Options for fasting lipid panel
 Lab request for fasting lipid
therapy
 In anti-platelet therapy
ire Management
 Sure is above goal (avg. over
 > 130/80, goal < 130/80)
 Other Anti-Hypertensives (Help
 2)
 Dretic 25 MG (25MG TABLET
 take 1) PO QD

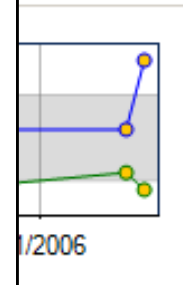
CAD/DM Smart Form: Graphs



CAD/DM SF: Patient View

Blood Pressure

On average, your blood pressure has been running high recently (average of 130/80 from your last two doctor visits). The recommended blood pressure goal is 130/80. You may want to discuss with your doctor about things you can do to help lower your blood pressure.



pneumonia at least once. If you have not had a pneumonia shot, you may want to discuss with your doctor whether you should get a pneumonia shot.

Most people with medical conditions such as yours receive a flu shot every year. If you have not had a flu shot this year, you may want to discuss with your doctor's office whether you should get a flu shot.

Smoking

If you are currently a smoker, you may want to talk to your doctor about ways to help you quit.

ARI and CAD/DM Pre Survey: Overall EHR use

- 223 clinicians responded (response rate 45%).
- Respondents had a mean age of 39 years old and were 40% men.
- Respondents were 197 physicians (88%), 24 nurse practitioners (11%), and 4 other clinician types (2%), including registered nurses and licensed practical nurses.
- Trainees – interns, residents, and fellows – made up 92 (41%) of respondents.



Pre survey contained questions about baseline computer use and about electronic health record use during patient visits.

Table 1: Reported Activities during Patient Visits*

During the visit, do you...	N	Never	Sometimes	Usually	Always
		N (%)			
Electronic health record use					
Correct/update the medication list?	221	24 (11)	45 (20)	85 (38)	67 (30)
Write at least part of the note?	220	65 (30)	59 (27)	48 (22)	48 (22)
Correct/update the problem list?	221	53 (24)	95 (43)	52 (24)	21 (10)
Correct/update health maintenance information?	221	60 (27)	97 (44)	47 (21)	17 (8)
Write full notes?	218	116 (53)	55 (25)	25 (11)	22 (10)
Modify the last note or template?	217	103 (47)	68 (31)	31 (14)	15 (7)
Correct/update other parts of the LMR?	191	102 (53)	50 (26)	30 (16)	9 (5)
Paper Use					
Write on the mini face sheet?	210	105 (50)	42 (20)	21 (10)	42 (20)
Write on a blank piece of paper?	213	74 (35)	75 (35)	32 (15)	32 (15)

*Rows may not add to 100% because of rounding.



Barriers to using the EHR during the patient visit

- The most commonly selected listed reasons for not using the EHR during patient visits were (N=223):
 - loss of eye contact with patient (62%)
 - falling behind schedule (52%),
 - computers being too slow (49%),
 - inability to type quickly enough (32%),
 - feeling that using the computer in front of the patient is rude (31%),
 - preferring to write long prose notes (28%).
- Less commonly indicated barriers included
 - computers “timing out” (19%),
 - a lack of fast, available printers (12%),
 - pop-up blocking software that interfered with the EHR (8%),
 - a lack of computers in some exam rooms (4%).

ARI RCT Post Survey

- A total of 73 intervention clinicians responded for a response rate of 28%.
- 56% (41) had used the ARI Smart Form during the RCT period.
- 75% of survey respondents said they would recommend the ARI Smart Form to a colleague.

Questions rated on a scale from 1-7 (1= Strongly Disagree, 7= Strongly Agree)	N responded	Mean
Recommendations in the ARI Smart Form are correct for my patients	41	5.34
The ARI Smart Form helps me comply better with ARI guidelines	41	4.68
The ARI Smart Form helps me improve quality of patient care	41	4.37
The ARI Smart Form is easy to use	40	3.92
The ARI Smart Form saves me time in the end	41	3.83
The ARI Smart Form improves my workflow	40	3.87
The ARI Smart Form has all the functions and capabilities that I expect it to have	40	4.23
I feel comfortable using the ARI Smart Form	40	4.47
The ARI Smart Form requires too many "clicks"	41	4.46

We also asked them to rate which Smart Form features they thought were most helpful.

Which ARI Smart Form features do you find to be the most helpful?	N (%)
Organizing data	14 (34)
Calculating risk of strep throat for ARI	13 (32)
Providing decision support	14 (32)
Documenting actions	20 (49)
Making it easier to prescribe medications	14 (32)
Making it easier to print patient instructions	25 (61)

ARI Smart Form Feedback

"Usually I do my notes after clinic ends and so I end up writing down hx and physical in brief short hand but with ARI I did note while patient was still there and did rx via ARI which is great!"

"The link to print work notes and patient information sheets are very nice. I would definitely use this as a documentation tool for URIs. I find it is as fast to use as my templated notes even for very simple things like pharyngitis."

"Overall I like it...And I think the recommendations are good which is obviously the most important thing."



CAD/DM Smart Form Post Pilot Survey

- We asked the CAD/DM pilot users (31) to fill out an online survey after using the CAD/DM Smart Form for 6 weeks.
- 15 pilot users (48%) completed the post pilot survey.
- 11 of these 15 (73%) users also completed the pre survey, allowing us to compare their pre and post responses.
- Of those 15 users, 10 (66%) would recommend the Smart Form to other clinicians unchanged.
- The other 5 suggested improvements we could make to the Smart Form that would make them more likely to recommend it.
- At least two of their suggestions have been implemented already for the RCT release.



CAD/DM Post Pilot Survey

- Survey results suggest that pilot users can see the benefits of using the CAD/DM Smart Form to treat patients with corresponding conditions.
- The majority of pilot clinicians agree that the CAD/DM SF helps them comply better with guidelines (60%) and helps them improve the quality of patient care (67%).

Question	% Agree or Strongly Agree
The CAD/DM SF helps me comply better with guidelines	60
The CAD/DM SF helps me improve quality of patient care	67
The CAD/DM SF is easy to use	20
The CAD/DM SF saves me time in the end	7
The CAD/DM SF improves my workflow	20
The CAD/DM SF has all the functions and capabilities that I expect it to have	13
The CAD/DM SF works well with the rest of the office staff	13



Most helpful Smart Form features

Features Most Helpful	% Agree or Strongly Agree
Providing assessments for each area of disease management	60
Organizing data	53
Providing suggested orders based on individual patient data	53
Printing patient instructions	53
Requests to provide patient info	47
Prescribing new medications	40
Adjusting existing medications	40
Documenting actions taken in the note	33
"Help Me Choose" links	27
Ordering follow-up appointments and referrals	20
Making it easier to write a visit note	13
Ordering laboratory tests	13



Pre and Post Comparison

How satisfied are you with your ability to carry out the following components of chronic disease management?

Percent satisfied or very satisfied:

	Pre Survey %	Post Survey %
Smoking	47	57
Weight	17	21
Diet and Exercise	6	29

CAD/DM SF Feedback

“This is the first LMR item that has allowed updating the health maintenance (smoking status) this is great.”

“I like the graphs...and to be able to put them in the note and have them right there without having to go out of the note is really nice.”

“What I like about the Smart Form is the way it sorts through the med and problem lists.”



More CAD/DM SF Feedback

Alan Cole, MD, Charles River Medical Associates, Chair of Partners Diabetes Council:

“The Smart Form is the easiest way to use the LMR. It provides access to vital signs and most labs and, in addition, permits entry of some data elements (e.g. vital signs and some Health Maintenance items) without screen changes or pop-ups. The Smart Form's decision support functionality assists compliance both by identifying deficits and streamlining most opportunities for correction. There are built-in individualized print-outs that serve as teaching tools that are useful and appreciated. I find myself using the Smart Form 5-10 times every day.”



**Elizabeth Mort, MD, MPH, Associate Chief Medical Officer,
MGH, HPM3 Team Leader :**

“The Smart Form allows me to *act* on information rather than spending time pulling it together. The trend graphics have made it easier to show patients where they are and where they need to be. I had a very difficult to manage, noncompliant patient with an A1C of 14. Showing the patient and her granddaughter the Patient View was critical in getting the whole family organized to support the patient. Her A1c came down to less than 9.”

Deborah Wexler, MD, MGH Diabetes Center :

The Smart Form is easy to use. It's fast and has some fabulous features (PE, ROS). BRAVO! I really think the Smart Form is time-saving."



What is a Quality Dashboard?

- Physician feedback system
- Clinician-level view of performance on problem-oriented quality indicators
- Comparison to:
 - Clinic
 - National benchmarks
- Drill-down capability
 - Summary measures → List of Individual Patients → Patient Charts/Smart Form



ARI Quality Dashboard Features

- Focus on total and unnecessary antibiotic use
- Narrow vs. broad spectrum antibiotics
- Stratified by type of ARI
- Relatively static because no further action can be taken on that patient

ARI Quality Dashboard

Total [ARI cases](#): 107
Antibiotic prescribing: 40

Note: For acute bronchitis and non-specific URIs the national guideline is zero.

provider n= 24 14 2 30 7 19 11

% ARI visits

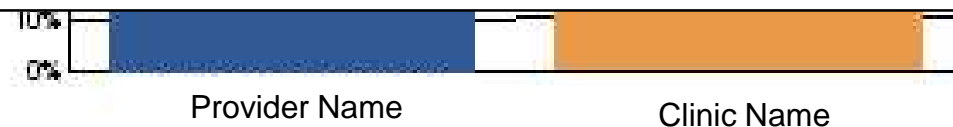
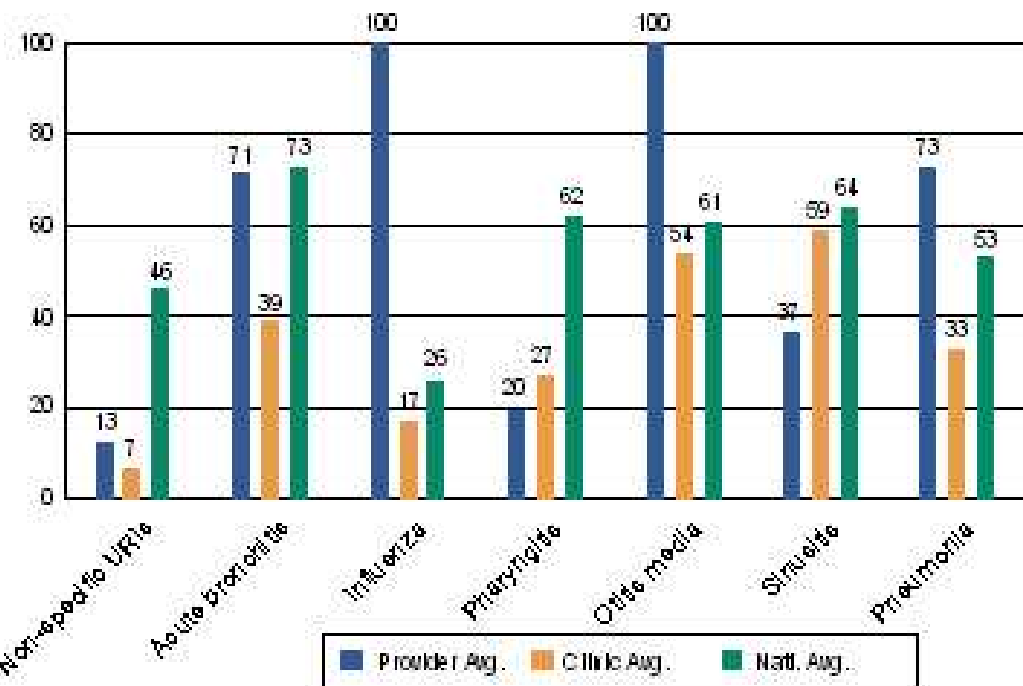
70
60

% ARI visits
with
antibiotics
by diagnosis

% Broad spectrum
prescribed in ARI
visits with
antibiotics

[Narrow spectrum](#):

[Broad spectrum](#):



ARI QD Feedback

- *Users find the ARI QD report with billing data (diagnosis and level of service codes) very useful since this type of reporting that combines LMR data with billing data is new.*
- *Users find the tool as a good test of system data check since reports are better with better coded value documentation, as opposed to free-text and outside data points.*



CAD Quality Dashboard Features

- Focus on several measures of CAD quality
- Graphical and tabular views
- Actionable
 - Individual patient: “drill down” to Smart Form
 - Lists of patients: link to EMR Patient List function for batch letters and documentation



CAD Quality Dashboard


PARTNERS Report Central | Provider: | Location: | Feedback

Reports | **Quality Dashboards** | Help | Admin

ARI Dashboard | CAD Dashboard

Targets are 90th percentile for HEDIS or for Partners providers

Red, yellow, and green indicators show adherence with targets

Measure	My Value (N)	Clinic Average (N)	Target
  ACE Inhibitor/ARB Management: % of patients on ACE inhibitor/angiotensin-receptor blocker	52% (55)	59% (1093)	> 78%
  BMI Documentation: % of patients with BMI documented	22% (23)	45% (839)	> 76%
  Smoking Status Documentation: % of patients with smoking status documented	18% (19)	32% (597)	> 87%
  Anti-platelet Management: % of patients on anti-platelet	81% (85)	79% (1479)	> 94%
  Beta-blocker Management: % of patients on beta-blocker	69% (72)	75% (1392)	> 80%
  Zero Defect Care: % of patients with zero deficiencies	27% (28)	50% (929)	> 68%
	75% (79)	72% (1352)	> 62%
	0% (0)	1% (14)	> 47%

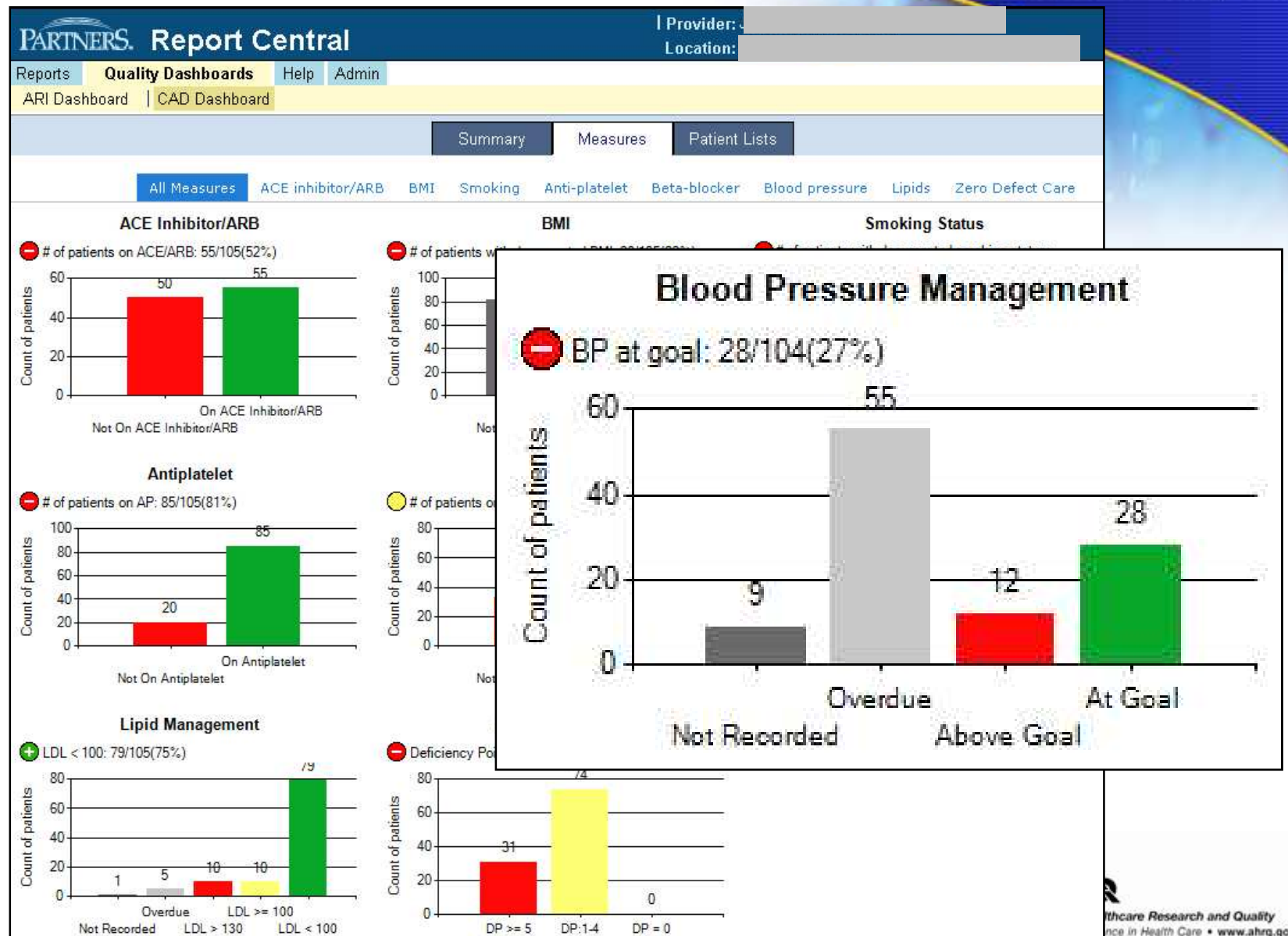
Total # of CAD Patients: 105

Zero defect care:

- Aspirin
- Beta-blockers
- Blood pressure
- Lipids



CAD Quality Dashboard



CAD Quality Dashboard



CAD Quality Dashboard

Filter. For example, patients with blood pressure not at goal who have had 0 or 1 visit in the past year

Filters ...													Show/Hide Filters: -																								
Lipids			Blood Pressure		Smoking Status		BMI		Anti-platelet		Beta-blocker																										
<input type="checkbox"/> At goal: <100	<input type="checkbox"/> LDL >= 100	<input type="checkbox"/> LDL >130	<input type="checkbox"/> Overdue	<input type="checkbox"/> Not recorded	<input type="checkbox"/> At goal	<input checked="" type="checkbox"/> Above goal	<input checked="" type="checkbox"/> Markedly above goal	<input checked="" type="checkbox"/> Out of date	<input checked="" type="checkbox"/> Not recorded	<input type="checkbox"/> Meet goal	<input type="checkbox"/> Do not meet goal	<input type="checkbox"/> Recently quit	<input type="checkbox"/> Out of date	<input type="checkbox"/> Not recorded	<input type="checkbox"/> At goal	<input type="checkbox"/> Above goal	<input type="checkbox"/> Markedly above goal	<input type="checkbox"/> Out of date	<input type="checkbox"/> Not recorded	<input type="checkbox"/> Meets goal	<input type="checkbox"/> Not on (indicated/ not contraindicated)	<input type="checkbox"/> Contraindicated	<input type="checkbox"/> Not indicated														
ACE-I/ARB			Future Visits		Visits in last year		Sex		Age		Zero Defect Care																										
<input type="checkbox"/> Meets goal	<input type="checkbox"/> Not on (indicated/ not contraindicated)	<input type="checkbox"/> Contraindicated	<input type="checkbox"/> Not indicated	<input type="checkbox"/> No scheduled visit	<input type="checkbox"/> Within 1 week	<input type="checkbox"/> Within 2 weeks	<input type="checkbox"/> Within 1 month	<input type="checkbox"/> Within 3 months	<input checked="" type="checkbox"/> 0	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3 or more	<input type="checkbox"/> Female	<input type="checkbox"/> Male	<input type="checkbox"/> Unknown	<input type="checkbox"/> <18	<input type="checkbox"/> 18-40	<input type="checkbox"/> 41-50	<input type="checkbox"/> 51-60	<input type="checkbox"/> 61-70	<input type="checkbox"/> 71-85	<input type="checkbox"/> >85	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	<input type="checkbox"/> 9	<input type="checkbox"/> 10	<input type="checkbox"/> 11	<input type="checkbox"/> 12	<input type="checkbox"/> 13	<input type="checkbox"/> 14
<p>Clicking on name opens patient's Smart Form</p>																																					
<p>Create a new list: <input type="text"/> Save to my Lists Export To Excel</p>																																					
<p>Patients returned: 3</p>																																					
<input type="checkbox"/>	<u>Name</u>	<u>MRN</u>	<u>Sex</u>	<u>Age</u>	<u>Visits (next)</u>	<u>LDL</u>	<input checked="" type="checkbox"/> <u>BP</u>	<u>AP</u>	<u>BB</u>	<u>ACE/ARB</u>	<u>Smoking</u>	<u>BMI</u>	<u>Defic</u>																								
<input type="checkbox"/>			M	49	1 (1/19/07)	88 (8/12/05)	145/78 (8/2/06)	N	N	N	N/A		6																								
<input type="checkbox"/>			M	34	1 (12/21/04)	67 (12/21/04)	135/80 (8/27/01)	N	N	N	N/A		6																								
<input type="checkbox"/>			M	58	1 (3/7/06)	69 (3/7/06)		Y	Y	N	Active (3/7/06)		4																								



CAD QD Feedback and Pilot Results

In general, pilot user feedback has been positive. All the physicians have commended the disease-specific snapshot reporting tool that allows them to navigate between measures and drill down to a specific patient view easily.

- Users like the ability to define the query and create their own list of CAD patients starting from the base set that the system generates.
- Users like the ability to see the snapshot view graphically as well as in summary format.
- Users find the tool as a good test of system data check since reports are better with better coded value documentation, as opposed to free-text and outside data points.



Quality Dashboards ↔ Smart Forms

Smart Forms and Quality Dashboards work together to improve quality

Same data feeds Quality Dashboards and Smart Forms

Smart Forms capture structured information that informs Quality Dashboards

Quality Dashboards allow clinicians to “drill-down” from a population view to individual patient Smart Forms to address quality deficiencies

The screenshot displays a clinical information system interface. On the left, there are tabs for 'Problems', 'Procedures', 'Meds', and 'Non-Meds'. The 'Problems' tab is active, showing a list of medical conditions such as 'Diabetes mellitus type 1', 'Coronary artery disease', 'DM-related', 'Onychomycosis', and 'Elevated creatine phosphokinase'. The 'Meds' tab is also visible, showing a list of medications including 'Acetylsalicylic ACID 325', 'MG (325MG TABLET take 1) PO QD', 'ACE-I/ARB', 'Lisinopril 20 MG (20MG TABLET take 1) PO QD', and 'Beta-Blockers'. The 'History of Present Illness' section is open, showing a list of symptoms and signs. The right panel displays a list of quality deficiencies, with several items circled in red: 'No recent LDL measurement', 'Blood Pressure is above goal (avg. over last 2 visits 130/80, goal < 130/80)', 'Patient is due for Pneumovax (older than 65, no record of prior vaccination)', 'Patient is due for Influenza Vaccine (high risk medical condition)', 'Patient may be Current Smoker, not thinking of quitting. Last counseled on 10/10/06', and 'Patient is overweight or obese (BMI 27.1 on 10/31/06, goal < 25)'. The interface also includes a 'Patient view' tab and a 'Reports' tab.

Evaluation

1. Usability testing
2. Pilot testing
3. Randomized controlled trials



Development and Usability Testing

- Focus Groups
- Prototype development
- Iterative refinement
- Pilot Testing
 - Real time on-line feedback
 - Surveys before and after use
 - Usability Lab
 - Interviews by outside consulting firm



ARI Smart Form – Pilot Results

	Smart Form Pilot		Previous Season	
	Visits, N	Antibiotic, N (%)	Visits, N	Antibiotic, N (%)
Antibiotic Appropriate Diagnosis	6	6 (100)	367	154 (42)
Non-Antibiotic Appropriate Diagnosis	20	3 (15)	1027	269 (26)



CAD/DM Smart Form – Pilot Results

	Smart Form Pilot		Previous 6 weeks	
	Deficiency	Deficiency Addressed	Deficiency	Deficiency Addressed
Beta-Blocker Rx or CI	3/134 (2.2)	2/3 (66.7)*	24/924 (2.6)	1/24 (4.2)
Up to Date Blood Pressure	14/134 (10.5)	13/14 (92.9)*	133/924 (14.4)	43/133 (32.3)
Smoking Status documented	45/134 (33.6)	11/45 (24.4)*	339/924 (36.7)	21/339 (6.2)
Up to Date Height and Weight	95/134 (70.9)	10/95 (10.5)*	634/924 (69.6)	34/643 (5.3)

*p < 0.05



Randomized Controlled Trials

- ARI Smart Form
 - Completed, analysis in progress
- CAD Diabetes Smart Form
 - In progress
- ARI Quality Dashboard
 - Nearing completion
- CAD Quality Dashboard
 - To begin after CAD DM Smart Form RCT completed



Challenges

- Dependence on external software development
- Physician vs. clinic level randomization
- Reconciling research agendas of several simultaneous IT projects
- Creating knowledge management infrastructure

Dependence on Software Development

- Smart Forms dependent on outpatient order entry and on LMR services
- Delayed product development and RCT start
- **Solutions**
 - Get development support at highest levels
 - Make needs clear
 - Prioritize and pick battles
 - Minimize dependence if possible
- **Lesson Learned:** Anticipate and manage

Physician vs. Clinic Level Randomization

- Clinic level
 - Pros: training and support easier, minimizes contamination
 - Cons: clustering by clinic, potential for uncontrolled confounding
- Physician level
 - Pros: no clustering, more effective randomization
 - Cons: training and support more difficult, potential for contamination among physicians
- **Lessons Learned:** be flexible and willing to re-evaluate as situations change



Reconciling Research Agendas of Multiple IT Projects

- Questions to Ask: How similar are...
 - The interventions?
 - Target patient populations?
 - External requirements?
 - Logistics of implementation
 - Outcomes to be measured?



Reconciling Research Agendas of Multiple IT Projects

- Conversion to multiple arm study
 - Good when overlapping interventions and outcomes
 - Sacrifices statistical power
- Simultaneous studies in different populations
 - Good when populations can be separated
- Simultaneous studies in same population (e.g., 2x2 factorial design)
 - Good when little chance of synergy between interventions
- Head to head comparison
 - Good when no overlap, each can serve as control for the other
- **Lessons learned:** need for broad dialogue among stakeholders



Creating Knowledge Management Infrastructure

- Cons
 - Large up-front investment
 - Potential delays in design
 - Bureaucracy
- Pros
 - Mechanism for connecting subject matter experts with programmers
 - Much more scalable as decision support expands
- **Solutions:**
 - Knowledge management group
 - I-log software



Creating Knowledge Management Infrastructure

- **Lessons learned**
 - Flow diagrams for subject matter experts
 - Other formats for analysts & programmers
 - Finalize logic among small group
 - Public e-space to promote dialogue
 - Detailed indexing of all logic elements
 - Re-use
 - Prevent redundancy



Lessons Learned: General

- Pilot data encouraging to date
- Potential synergy between Smart Forms and Quality Dashboards
- New paradigms for decision support



Lessons Learned: Smart Forms

- Major barriers to use relate to workflow and human factors issues
- Coded data entry
 - What is the correct amount?
 - May depend on complexity of condition, degree to which data influences decision support, billing requirements, style of individual practitioner



Lessons Learned: Smart Forms

- ARI
 - Greater impact on promoting appropriate antibiotic use than discouraging inappropriate use?
 - Better coding of diagnoses vs. more appropriate care
 - So far, limited to stand-alone ARI visits
 - Will be addressed in future versions

Lessons Learned: Smart Forms

- CAD/DM
 - Impact greater on documentation than on clinical inertia?
 - Biggest barrier is change to current workflow
 - Future versions will incorporate health maintenance, other acute and chronic conditions, other features to make it more appealing to use
 - Can we reach the tipping point?



Lessons Learned: Quality Dashboards

- Biggest barriers to use are related to the health care system
 - What are the drivers (carrots and sticks) to QD use?
 - Pay for performance
 - Reimbursement for case management
 - For chronic diseases, QD may be more effective as a case management tool

Lessons Learned: Quality Dashboards

- Other major barrier is related to quality of the data
 - Absolute need to tie patients to providers, edit panels, deal with missing data
 - Won't change behavior unless the data are believable
- Big societal trends will drive quality measurement
 - Can providers be proactive? (EHR data better than billing data)



Lessons Learned: HIT Research

- Challenges include IT implementation among providers, external dependencies, randomization issues, competing interventions, and knowledge management
- Concurrent RCTs superior to before-after trials if can be done
- Anticipate and manage problems, but be prepared to be flexible if conditions change



Conclusions

- Smart Forms and Quality Dashboards offer new paradigms to manage acute and chronic medical conditions using EHR technology
- Both have potential to improve care, demonstrate EHR value to providers, and drive EHR use
- Much work remains to be done



Managing Smart Forms Project

Highlights from the past 3 years



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HIT project from the management perspective

- Challenges
 - Tough goal
 - Smart, motivated people
 - New challenges every day
- Rewards
 - Tough goal
 - Smart, motivated people
 - New challenges every day



vase or 2 faces?

Challenges

Every stage has its own unique challenges

- Development
- Study design
- Implementation
- Data analysis
- Manuscript preparation



Development

- Software created was very complex
 - Different forms (ARI and CAD)
 - LMR dev team has its own agenda
 - Involvement of other Partners' departments (KM)
 - Incorporating usability expertise and feedback
- Design challenges
- Consideration of needs of a diverse group of clinicians
- Financial struggle to support developers for research purpose (CAD QD)
- Any dev delays caused delays for whole project

Study design and data collection

- Multiple research studies ongoing at Partners created a need for very careful study design and complicated randomization schemas
- Lack and disparate information (PCP lists, residents lists)
- On-line surveys yielded typical response rate

Training and implementation

- Selling the idea to practices
 - Practice leaders
 - End users: physicians and residents
- Implementation
 - Accommodate practice readiness & scheduling
- Training
 - Comply to needs of different users
 - Provide personal training if needed
- Support after implementation
- Additional resources for implementation process would help to increase usage

Analysis

- Time consuming and tedious
- Extremely complex programming
- Cleaning data requires on-going involvement of co-investigators
- Data retrieval process
 - Unique for BWH and MGH patient data
 - No central place to get data

Team issues

- Strong personalities with different ideas
- Not everyone is born to be a perfect team player
- Loss of key people during the study



Nature of doing HIT research at Partners

- Co-investigators and PI work on numerous projects
- Work between physicians and developers
- Cooperation with different groups (CITL, CIRD, QDM) – necessary, hard, and beneficial
- Partners culture around research work
 - Why research is needed
 - What research needs are
 - Issues with access to research DB, data, etc.
- Distance between
 - Research team and co-investigators
 - Research team and clinics
 - Co-investigators and developers



How did we succeed?

- Team excellence
 - Right team composition
 - Experience in different areas
 - Previous research experience
 - Goal oriented
 - Ability to manage team challenges
- High involvement of co-investigators at all stages of the grant
- Previous experience with conducting similar research at Partners
- Early determination of research questions and data of interest (Analysis Plan)



Strong management & project management

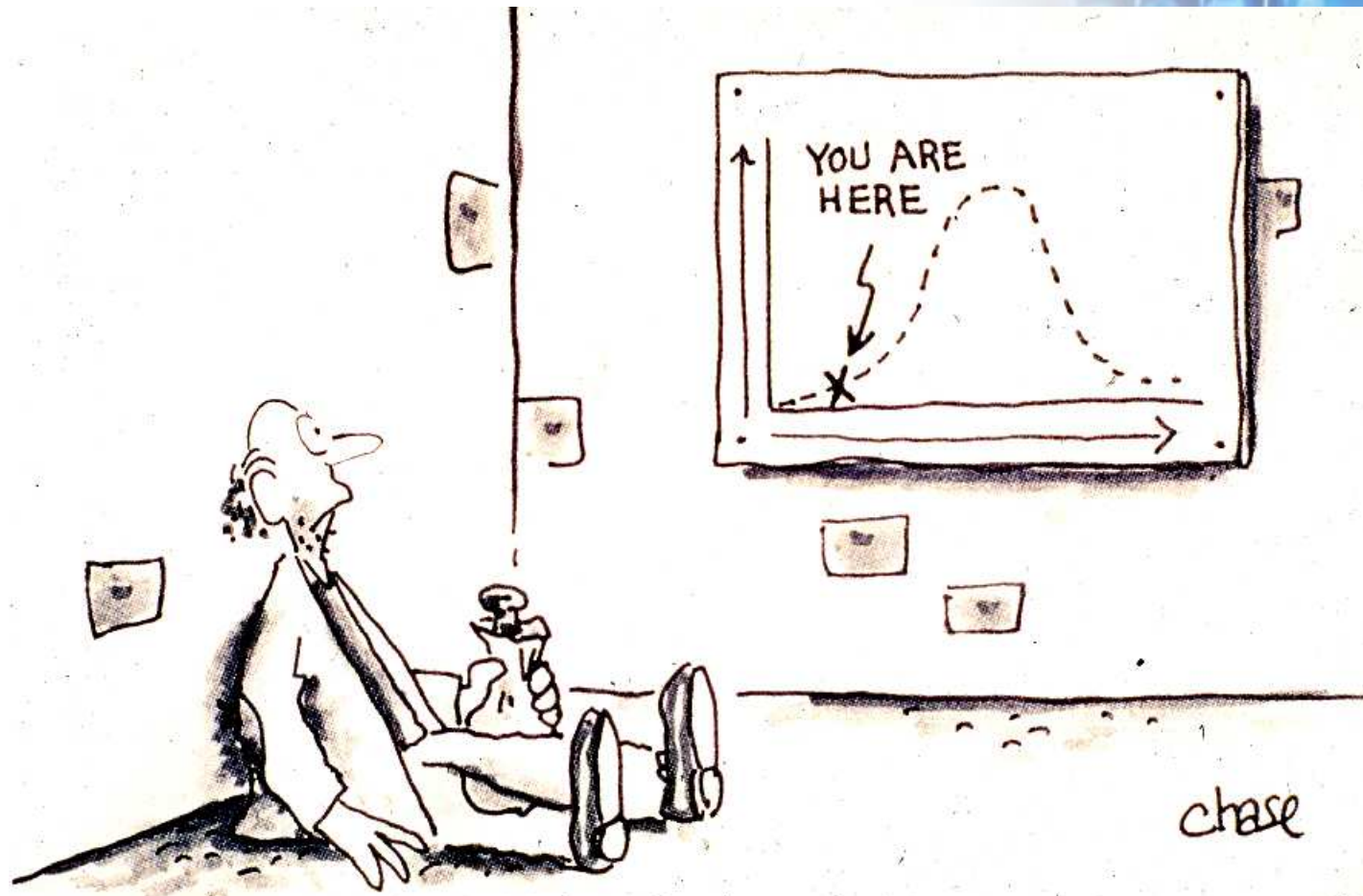
- Decision-making hierarchy (buck stopped with the PI)
- High involvement of co-investigators
- Communication / negotiation skills
- Careful proactive planning for every project stage
- Weekly meeting for the whole team
- Agenda and “To-Do” items on weekly basis
- Documentation of all steps (including research DBs development)
- Learning during Pilot stages to have smooth RCTs

Rewards

- Accomplishing difficult tasks
- Positive feedback from physicians
- Results dissemination at national conferences and through manuscripts
- Getting feedback from a wide range of researchers
- Making a difference in patient care?



Where Are We?



chase



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Discussion, Q&A

Thank you!

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